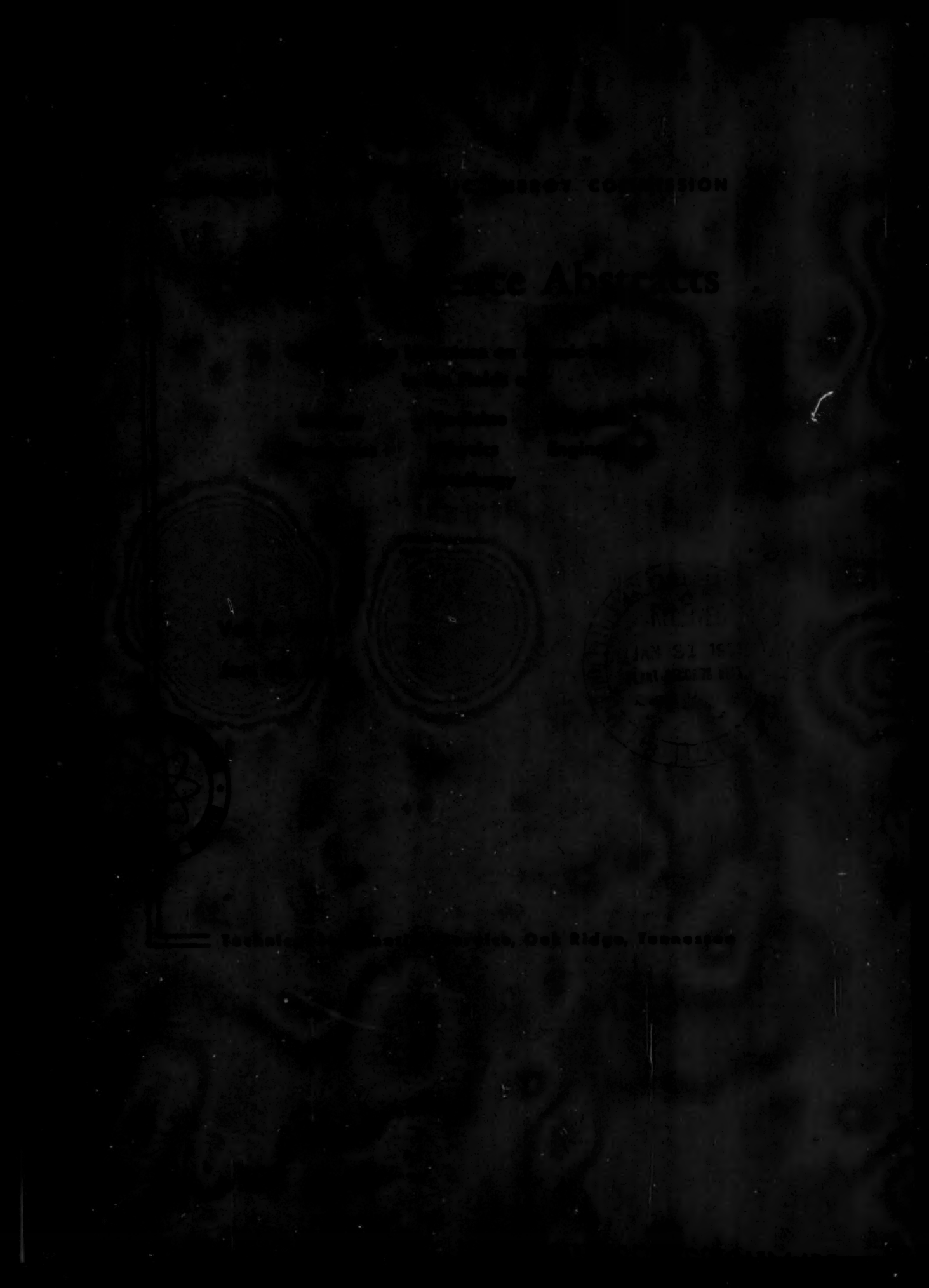

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NUCLEAR SCIENCE ABSTRACTS

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NUCLEAR SCIENCE ABSTRACTS

GENERAL

ATOMIC BOMBS AND WARFARE

1

Los Alamos Scientific Laboratory
GRAVITY WAVES IN WATER CAUSED BY EXPLOSIONS. W. G. Penney. [nd.] Decl. Apr. 25, 1950. 13p. (AECD-2949; LADC-616)

Gravity wave systems generated by explosions above, on, or under the water surface are discussed. A comparison is made between the theoretical results, obtained entirely from first principles, and those experimental results which are available. The agreement is reasonably good. The wave systems from large explosions are found to be unimpressive. (auth)

2

THE HYDROGEN-COBALT BOMB. James R. Arnold. Bull. Atomic Scientists 6, 290-2(1950) Oct.

The main points of a previous statement by Dr. Leo Szilard to the effect that a hydrogen bomb could be rigged to disperse lethal radioactive dust over the face of the earth are reviewed and the probable validity of each one is examined. The over-all verdict is summed up as follows. It is almost certainly not true that a weapon of the type described can wipe out the human race completely. It is possible, however, that the vast majority of the race can be killed off in this way, although a full-scale effort by a major country over many years would be required. All in all, then, the human race is in no immediate danger.

3

THE PHYSICIAN IN AN ATOMIC WAR. P. Allweiss-Alvet. Münch. med. Wochenschr. 92, 705-14(1950) Aug. 4. (In German)

On the basis of the experience gained in Hiroshima, Nagasaki, and the Eniwetok Atoll, an outline is made of the pathological damages produced by the bomb and of the therapeutical and preventive possibilities to be considered in atomic warfare.

ATOMIC POWER

4

THE IMPLICATIONS OF ATOMIC ENERGY. New York, St. John's University, 1950. 176p.

Results of a study of the practical aspects of atomic energy made by five faculty members of St. John's University are presented under the following titles: Scientific Aspects of Atomic Energy, by Edward V. O'Brien; Society and the Atom, by Walter L. Willigan; The Impact of Atomic Energy on Law, by Ralph A. Newman; The Economic Consequences of Atomic Energy, by Arpad F. Kovacs; and The Ethical Implications of Atomic Energy, by Joseph G. Scully. 132 references.

5

INDUSTRIAL APPLICATION OF ATOMIC ENERGY. Nature 166, 535-6(1950) Sept. 30.

A brief summary of information presented at the Birmingham, England meeting of the British Association on the problems and prospects of industrial applications of atomic energy is presented. New types of power reactors under consideration are described, and some industrial applications of isotopes are given.

6

PROSPECTS IN INDUSTRIAL APPLICATION OF ATOMIC ENERGY. Philip Sporn. Bull. Atomic Scientists 6, 303-6(1950) Oct.

The article discusses the following topics: problems of reactor development, with U^{235} and plutonium as fuels, and analogies to a coal-fired boiler; the reactor development program with reference to four types of reactors for (1) materials testing, (2) use in propelling naval vessels, (3) breeding, and (4) electric power; industrial effects of atomic power, relating the discussion to present costs and uses of electric power; and atomic power and the coal industry.

RESEARCH PROGRAMS

7

Office of Naval Research, London
HIGH TEMPERATURE THERMODYNAMIC PROPERTIES OF INORGANIC SALTS. George J. Szasz. Mar. 28, 1950. 5p. (ONRL-38-50)

A research program at the University of Zurich for an investigation of the thermodynamic properties of simple inorganic salts by means of their ultraviolet spectral intensities is described. Schematic diagrams and descriptions

of one piece of apparatus for high pressure and high temperature work and of two high temperature furnaces for spectroscopic work are included.

8

Office of Naval Research, London
PHYSICAL CHEMISTRY RESEARCH, UNIVERSITY OF GRAZ. George J. Szasz. Mar. 29, 1950. 4p. (ONRL-40-50)

The three main lines of investigation deal with x-ray structure analysis, ultraviolet absorption spectroscopy, and dipole moment studies. The ultraviolet absorption spectra of naturally occurring polypeptides have been studied using polarized radiation. No actual results are reported. (auth)

BIOLOGY AND MEDICINE

9

HEMOSTATIC PROPERTIES OF TWO INDOLIC SUBSTANCES DERIVED FROM ADRENOCHROME. P. Fischer and P. Trabert. Experientia 6, 392-3(1950) Oct. 15. (In French; brief report)

Dihydroxymethylindole and dihydroxymethylindoxyl monohydrate have been found to decrease the mean bleeding time when tested by the rabbit's ear technique.

10

INVESTIGATION OF HEPATIC FUNCTION BY CLEARANCE TECHNIQUES. Alvin E. Lewis. Am. J. Physiol. 163, 54-61(1950) Oct. 1.

Equations have been derived which analyze the kinetics of clearance and the distribution of compounds injected intravenously. These have been applied to the study of the hepatic clearance of bromsulfalein in fed and fasted normal rabbits. Bromsulfalein is confined to the plasma until excreted by the liver. Below saturation levels hepatic clearance is independent of plasma concentration. Determinations of clearance and maximum excretory capacity indicate that fasting diminishes blood flow to the liver. Hepatic clearance varies with hepatic blood flow, but maximum excretory capacity does not vary with blood flow. Changes in blood flow to the liver in response to feeding or fasting are controlled by arteriolar beds outside the liver and are not appreciably affected by arterioles within the liver. (auth)

11

USEFUL LOCAL AND GENERAL HEMOSTATICS IN THE MANAGEMENT OF ABNORMAL BLEEDING. Leandro M. Tocantins. Delaware State Med. J. 22, 265-70(1950) Sept.

A general discussion of the mechanism of hemostasis and of the use of systemic and local coagulants, such as vitamin K, ascorbic acid, testosterone, protamine, toluidine blue, thrombin, and plasma fractions, in the control of hemorrhage is presented.

RADIATION EFFECTS

12

THE EFFECT OF X-RAY UPON THE GROWTH AND INFECTIVITY OF ENDAMOEBA HISTOLYTICA. Elvio H. Sadun, Joseph N. Ane, Frances Willard Fuller, and Ruth Lewis. Am. J. Trop. Med. 30, 635-40(1950) Sept.

A brief study of the effect of x-ray treatment in vitro upon the culturability, reproduction, and infectivity of Endamoeba histolytica was carried out. It was observed that single irradiations up to 120,000 r failed to kill or inactivate the organisms in Shaffer-Frye and Balamuth media. Exposure of the "streptobacillus" up to 120,000 r failed to produce any change in its ability to permit growth of amebae in S-F medium. Exposure of amebae in Balamuth culture up to 30,000 r did not seem to affect visibly the normal cycle of population growth. On the other hand, exposures to 60,000 and 120,000 r seemed to inhibit, somewhat, amebic population growth. Viable amebae were observed for 16 transfers after irradiation with 120,000 r. Injection of the progeny of the x-rayed amebae (120,000 r) into normal guinea pigs produced severe intestinal lesions just as did the unexposed controls.

13

FUNCTIONAL AND STRUCTURAL CHANGES CONSEQUENT TO HIGH DOSAGES OF RADIOACTIVE IODINE. Aubrey Gorbman. J. Clin. Endocrinol. 10, 1177-91(1950) Oct.

Several years of observations on sequelae in mice subsequent to administration of high, radiotoxic doses of I^{131} are summarized, and the results are related, wherever feasible, to the human organism. Undesirable sequelae which have been found in mice include curtailment of growth, failure of functional and regenerative properties in the thyroid surviving less than thyroid-lethal doses, parathyroid injury, tracheal injury and tumors, recurrent nerve injury, ovarian sterilization, and fatal adenohypophyseal tumors. The dosage level from which most of these changes occur in mice, depending on the criteria consulted, are as much as 20 times as great or as little as 4 times as great as the doses given humans for therapy of hyperthyroidism. Some of the sequelae may be peculiar to mice, as well as to the dosage levels used. The remainder are serious enough to require further inquiry concerning their significance or possible roles in radiation therapy of human thyroids. It is recommended that use of I^{131}, at the present time, be restricted to aged or inoperable individuals. When the malady treated is not a fatal one, and unless there are no alternative methods of treatment available, it does not yet seem worth while to accept the risks implicit in the use of this powerful agent.

14

GREYING OF HAIR. II. RESPONSE OF INDIVIDUAL HAIRS IN MICE TO VARIATIONS IN X-RADIATION. Herman B.

Chase and Harold Rauch. J. Morphol. 87, 381-91(1950) Sept. (See also NSA 2-1323).

The graying response of hair to radiation is being studied by irradiating mice with up to 1500 r from 100- and 200-kv x-ray therapy machines, a 20-million-volt betatron, and a 50-mg radium needle. Later papers will report the histological and cytological studies, the graying response in other animals, and the comparison of different types of graying. The present paper deals with counts of individual hairs of different types. By means of individual hair counts it is possible to record the graying response in terms of percentage of hairs fully pigmented, mosaic, and all white. Dose-response curves are plotted for different radiation sources, for different dose rates, for fractionated doses, and for active and inactive follicles. The various hair types respond to radiation with different percentages of all-white hairs. The smallest type, the zig-zag, is the most sensitive. Discussion is presented on the hypothesis that radiation affects the melanoblast source of pigment granules for each follicle.

15

RADIOACTIVITY AND COSMIC RADIATION AS BIOLOGICAL FACTORS. Josef Penkava. Sborník Československ. Akad. Zemědelské 22, 448-66(1950). (In Czech)

An elementary outline of the progress and the present state of knowledge of the biological effects of radiations is presented.

16

STUDIES ON THE EFFECTS IN VITRO OF ROENTGEN RADIATION ON THE BIOLOGICAL ACTIVITY OF THE AGENT OF CHICKEN TUMOR I (ROUS SARCOMA). W. Ray Bryan, Egon Lorenz, and John B. Moloney. J. Natl. Cancer Inst. 10, 1215-37(1950) June.

The relation between dose of x radiation and the surviving activity in irradiated samples of the agent of chicken tumor I (Rous sarcoma) was determined in six experiments carried out with quantitative bioassay techniques. The characteristics of the dose-survival curve were found to vary with the method of preparation, and with the relative "purity," of the tumor-agent suspension subjected to irradiation. The suspensions investigated ranged from crude extracts of tumor tissue to a microsome fraction which had been separated and partially "purified" by two cycles of differential centrifugation. The diameter of the radiosensitive structure of unit particles of chicken tumor I agent is estimated from the best results of this series of experiments to be 46 to 49 mμ. The possible implications of this finding with respect to internal structure of the unit particles are discussed. Evidence is presented that aggregation of constituents of the microsome fraction, with which the active tumor agent is associated may be responsible, at least in part, for the variations among dose-survival curves observed in the different experiments. (auth)

RADIATION HAZARDS AND PROTECTION

17

Los Alamos Scientific Laboratory
DECONTAMINATION. J. F. Newell. [nd.] Decl. Sept. 14, 1950. 2p. (LADC-789)

This report comprises simply a photograph of a pilot disposal plant where biological methods of purifying the waste water from contaminated laundry are being studied. Because this laundry washes clothes which may be contaminated with Pu particles, its waste water cannot be allowed to run off until the contamination is removed.

RADIATION SICKNESS

18

THE EVALUATION OF VITAMIN P-LIKE COMPOUNDS FOR THEIR ABILITY TO MODIFY CAPILLARY PERMEABILITY USING THE PROCAINE-BISULFITE METHOD. Thomas J. Haley and Bonnie M. Rhodes. Aug. 8, 1950. 18p. (UCLA-86)

A large series of "vitamin P-like" compounds of varying basic structures have been evaluated for their capillary permeability effects using a procaine-bisulfite method adapted for use with mice. The results obtained are independent of the pH value of the injected solutions, the solubilizers used, or the sugar(s) attached to the molecule. Hydroxyl groups on the substituent benzene in positions 2 or 3 have played no part in potency under the experimental conditions employed. The glycoside linkage serves to detoxify and probably to aid in solubilizing the flavonoid pigments. The opening of the pyrone ring to form a chalcone derivative of phloroglucinol is essential to activity. The formation of a quinoid structure appears to be associated with physiological activity in the flavonoid series. However, phloroglucinol and the catechins are exceptions because quinones cannot be formed, yet the compounds have considerable activity. It has been suggested that the flavonoid compounds exert their capillary permeability effects by preventing relaxation of the precapillary sphincters of the capillary bed by inhibiting the conversion of adenosine diphosphate into adenosine triphosphate. (auth)

19

THE USE OF BAL IN THE TREATMENT OF SKIN REACTIONS DUE TO GOLD THERAPY. M. M. Montgomery. Ann. Internal Med. 33, 915-24(1950) Oct.

The reactions of two patients to treatment of severe exfoliative dermatitis due to gold salts with BAL, dithiopropanol, are described, and necessary precautions in the use of this drug are suggested.

20

THE USE OF BRITISH ANTI-LEWISITE (BAL) IN THE TREATMENT OF DIABETIC NEUROPATHY. CLINICAL STUDY; PRELIMINARY REPORT. Robert W. Schneider. Cleveland Clinic Quart. 17, 197-208(1950) Oct.

Previous research has indicated that some peripheral neuropathies other than those associated with heavy metal intoxication might be helped by the administration of BAL. In an attempt to appraise its clinical value in the treatment of various neurologic complications of diabetes, twenty-two patients with diabetic neuropathy have been treated with BAL; 12 have been relieved of their pain and, to a large extent, the subjective distress attending the neuritis. Eight of these experienced temporary intensification of pain following almost every injection, and have remained free of recurrences. Four showed no intensification of distress,

but tended toward relapse. Ten patients experienced no benefit. A possible explanation for failure has been presented and a recommendation for early treatment has been advocated.

RADIOTHERAPY

21

ATOMIC WEAPONS AGAINST CANCER. E. N. Lockard. Yale Review 40, No. 1, 136-48(1950).

A popular account of the nature and production of radioisotopes and of their application in cancer research and therapy is presented, with a brief discussion of the Atomic Energy Commission cancer program.

22

BRITISH EMPIRE CANCER CAMPAIGN. TWENTY-SEVENTH ANNUAL REPORT. Heneage Ogilvie, Ed. London, British Empire Cancer Campaign, 1950. 388p.

The results of investigations completed and the status of those in progress during the year 1949 at more than 50 hospitals and institutions engaged in research on cancer are presented in this extensive report. The principal fields covered by these investigations are carcinogenesis, biochemistry, heredity, cell biology, chemotherapy, radiation chemistry, biological effects of radiation, applications of radioisotopes, radiation physics, radiotherapy, and surgery.

23

CANCER THERAPY BY MEANS OF SLOW NEUTRONS; PRELIMINARY STUDY. José W. Otte and Eduardo Sanchez Serrano. Toko-ginecol. práct. 9, 1-15(1950) Jan. (In Spanish)

The author irradiated cancers of the uterus and the breast with slow neutrons (4×10^3 neutrons/cm^2/sec), the tissues having been previously impregnated with B or Li (iontophoresis). In this preliminary note a few general observations only are reported on the histological, hematological, and therapeutical effects of the irradiation of chronic ulcerous necrotic lesions.

24

CANCER OF THE UTERUS; ITS EARLIER DIAGNOSIS AND MORE EFFECTIVE TREATMENT. Howard B. Hunt, E. Stanley Pederson, and Robert M. Coleman. S. Dakota J. Med. Pharm. 3, 5-12(1950) Jan.

The symptoms and treatment of carcinoma of the uterus are discussed. It is concluded that the most effective treatment for carcinoma of the cervix is properly administered radium and deep x-ray therapy. Comparative results from treatment of carcinoma of the cervix show absolute 5-hr survival rates of 20.5% with radium alone, 42.1% with radium and deep x ray in state cases, and 68.1% in all private practice cases. The optimum treatment for carcinoma of the endometrium is pre-operative deep x ray and fractionated radium followed by radical panhysterectomy after 6 weeks in operable cases.

25

MALIGNANT TUMORS AND THE RADIUM-ROENTGEN THERAPY. S. Scaglione. Boll. soc. ital. biol. sper. 26, 23-4(1950) Jan. (In Italian)

The author observed 3 cases of malignant tumors of the uterus and the ovary, which appeared to be directly caused by the x-ray treatment of the myoma of the uterus, applied 10 to 15 years previously. The debated problem of the carcinogenic action of x rays and radium on the genital organs is discussed.

26

PLESIOROENTGENTHERAPY; ITALIAN CONTRIBUTION. Felice Perussia. Scientia med. ital. 1, 303-17(1950) Apr.-June.

The term plesioroentgentherapy was introduced by the author in 1935. A short survey is made of the contribution of Italian workers in this field.

27

REPORT ON RADIUM THERAPY FOR 1949. Robert E. Fricke and Martin Van Herik. Proc. Staff Meetings Mayo Clinic 25, 591-3(1950) Oct. 11.

Statistics are given on the patients treated during 1949 for various malignant and nonmalignant diseases by the application of radium or radon in the Section on Therapeutic Radiology of the Mayo Clinic.

TOXICOLOGY STUDIES

28

ARSENIC POISONING AND BAL. Hans Schwab. Deut. med. Wochenschr. 75, 272-4(1950) Feb. 24. (In German)

An unusual case of arsenic poisoning through an accidental intravenous injection of a solution containing 4.4 g of sodium cacodylate is described. The very grave symptoms were removed by an intramuscular injection of BAL (4.5 cc) applied 22 hr after the accident.

29

BERYLLIUM AND GROWTH. I. BERYLLIUM-INDUCED OSTEOGENIC SARCOMATA. M. B. Hoagland, R. S. Grier, and M. B. Hood. Cancer Research 10, 629-35(1950) Oct.

Twenty-four rabbits were injected with insoluble beryllium compounds, and 7 animals developed osteogenic sarcomas in from 11 to 24 months after injection. These tumors were highly malignant and metastasized rapidly. Seven other injected rabbits apparently dying of unrelated causes were found to have remarkably fibrotic and contracted livers. All attempts to transplant these tumors met with failure. The serum alkaline phosphatase activity rose rapidly, paralleling the spread of the tumor throughout the body, and the activity of this enzyme in the tumor tissue itself was extremely high. Magnesium was found to activate, and beryllium to inhibit, the phosphatase associated with the sarcoma in the same manner that these metals affect normal alkaline phosphatase. The importance of an ex-

tremely malignant sarcoma produced by a simple metal oxide, in the light of the known effects of beryllium on certain enzyme systems, is discussed. (auth)

30

FLUORINE TOXICITY IN TOMATO AS MODIFIED BY ALTERATIONS IN THE NITROGEN; CALCIUM, AND PHOSPHORUS NUTRITION OF THE PLANT. E. G. Brennan, I. A. Leone, and Robert H. Daines. Plant Physiol. 25, 736-47(1950) Oct.

With recent advances in the use of fluorine as a raw material in many manufacturing processes, it has become more and more obvious that certain compounds of this element are responsible for injury to crops, native vegetation, and ornamental plantings in the vicinity of such industries. The present investigation was conducted to determine the role of nitrogen, calcium, and phosphorus in influencing plant susceptibility to injury from fluorine supplied as NaF in the nutrient substrate or as HF in the atmosphere. The effects on the tomato plant of various concentrations of these elements are described in detail.

TRACER APPLICATIONS

31

EFFECT OF QUINONES AND OTHER REAGENTS ON THE RESORPTION OF RADIOACTIVE PHOSPHATE BY YEAST. O. Hoffmann-Ostenhof and Else Kriz. Monatsh. 81, 90-100(1950). (In German)

The furthering influence of quinones (in 10^{-4}M concentration) on the resorption of P by yeast from a solution of $(NH_4)_2P^{32}O_4$ was confirmed in a series of experiments. It was also found that certain substances (NaF, riboflavin, nicotinic acid and others) cause a reverse movement of P from the yeast cells into the solution.

32

THE METABOLISM OF THE SNAIL INVESTIGATED BY MEANS OF HEAVY WATER. H. J. Vonk, J. C. A. Mighorst, and A. P. de Groot. Physiol. Comp. Oecol. 2, 51-8(1950) Mar.

Snails, just awakened from hibernation, were given food mixed with a 3% D_2O solution; a 1 to 1.5% D_2O content in the animals' blood and tissue fluids was rapidly obtained; the incorporation of D was proved by the analysis of dried tissues and of isolated glycogen and fatty acids. The central position of the liver in the metabolism of the snail was confirmed.

33

"RADIANT PLANTS." RADIOACTIVITY AS A RESEARCH AID IN BOTANY. S. Gericke. Umschau 50, 568-9(1950) Sept. 15. (In German)

The use of radiophosphorus, P^{32}, in determining the uptake and distribution of phosphorus in growing plants is illustrated by radioautographs.

34

RADIOACTIVE IODINE FOR DIAGNOSTIC PURPOSES. Rolf Bull Engelstad. Norsk Laegefor. Tids. 70, 224-5 (1950) Apr. (In Norwegian)

Two cases are reported of the use of I^{131} in the diagnosis of thyroid diseases. In a case of thyreotoxic goiter, after four operations the whole gland was supposed to have been removed. With the aid of I^{131} and a Geiger counter, the pyramidal process was proved to persist. The other case presented an enlarged gland and enlarged cervical lymphatic nodes; however, the biopsy could not ascertain the malignity. By using I^{131}, node metastases, and, consequently, the malignity, were established.

35

RADIOACTIVE ISOTOPES OF IRON AND THEIR USE IN CHEMISTRY AND BIOLOGY. V. I. Goldanskiĭ and M. B. Neĭman. Uspekhi Khim. 19, 320-41(1950). (In Russian)

This is a review of principal works on all known isotopes of iron, methods of preparation of samples of Fe^{59}, applications of Fe^{59} in chemistry and metallurgy, and the use of that isotope in the study of iron metabolism. 114 references.

36

RADIOACTIVE PHOSPHORUS AND PLANT NUTRITION. S. Gericke. Landw. Forsch. 1, 133-140. (In German)

In an elementary note, a few facts are given on the use of radioactive P in plant physiology, as reported by the Institute of Iron Studies in Dusseldorf, Germany (which is interested in agricultural uses of the Thomas slag).

37

RADIOACTIVE TRACERS. G. B. Gazzaniga. Scienza e lavoro 5, 459-61(1950) Aug. (In Italian)

An elementary note on isotopes and radioactive tracers and their applications is given.

38

ROLE OF BROMINE IN ANIMAL BODY. I. DISTRIBUTION OF BROMIDES IN THE BODY OF RATS, DETERMINED WITH THE AID OF RADIOBROMINE. I. N. Verkhovskaya. Izvest. Akad. Nauk S.S.S.R., Ser. biolog., 114-27(1950) Jan.-Feb. (In Russian)

The distribution of bromides in the body of the rat was studied with the aid of Br^{82}. The highest relative radioactivities were observed in blood, urine, the medullary portion of the kidneys, the thyroid, and the hypophysis; in the latter the activity was sometimes very high. Medium values of the relative activity were shown by the lungs, liver, spleen, adrenals, salivary and lymphatic glands, and testes and ovaries. Very low values were obtained from various parts of the brain. (auth)

39

Field Research Laboratory (Fort Knox)
THE UPTAKE AND CONVERSION OF RADIOACTIVE IODINE (I^{131}) BY THE THYROID GLAND IN VIVO AND IN VITRO IN TOURNIQUET SHOCK IN RATS. M. W. Hamolsky, Z. S. Gierlach, and H. F. Jensen. June 9, 1950. 12p. (NP-1672)

The thyroid function in experimental "tourniquet shock" in rats with and without saline treatment has been evaluated by using thyroid uptake and conversion of radioactive iodine, I^{131}, in vivo and in vitro. The effects of adrenalectomy on thyroid response in tourniquet shock have also been studied.

There was an early and progressive decrease in the amount of I^{131} present in the thyroid gland of rats subjected to tourniquet shock and of its organic conversion late in shock. Administration of 0.9% saline partially reversed this disturbance. Adrenalectomy did not significantly alter the disturbance. There was no demonstrable disturbance of in vitro uptake or organic conversion early in shock, and only a slight change late in shock.

CHEMISTRY

40

Rensselaer Polytechnic Institute
SOLVENT EXTRACTION OF INORGANIC IONS (SIXTH QUARTERLY PROGRESS REPORT). L. G. Bassett, W. H. Bauer, H. M. Clark, S. E. Wiberley, J. Savolainen, A. Laurene, and D. Campbell. Aug. 1, 1950. 29p. (NYO-611)

Ultraviolet absorption studies on the ferric perchlorate, perchloric acid, water system at low acidity show evidence for the existence of a Fe(OH)x complex. When hydrochloric acid is added to this system, a new absorption band, attributed to the formation of a $Fe(Cl)^{++}$ complex, appears at 3400 A. The association constant for the formation of this complex has been calculated for solutions of both low and high ionic strength. It is believed that other iron chloride complexes besides $Fe(Cl)^{++}$ are also present in solutions of high ionic strength. (auth)

41

ORGANOMETALLIC COMPOUNDS OF THE FIRST THREE PERIODIC GROUPS. G. E. Coates. Quart. Revs. 4, No. 3, 217-35(1950).

A general review of the chemistry, molecular structure, and nature of bonds of the organometallic compounds of the elements of groups I, II, and III of the periodic system is presented. 50 references.

42

REACTIONS OF IODINE MONOHALIDES IN DIFFERENT SOLVENTS. F. W. Bennett and A. G. Sharpe. J. Chem. Soc., 1383-4(1950) May.

The course of the reaction between iodine monochloride and phenols varies with experimental conditions; in the absence of a solvent the main reaction is chlorination, in solution it is iodination. Iodine monobromide always acts as a brominating agent. The relation between such reactions and the physical properties of the solvents and reactants is discussed. (auth)

43

Naval Research Laboratory
THE SPREADING OF LIQUIDS ON LOW-ENERGY SURFACES; I. POLYTETRAFLUOROETHYLENE. H. W. Fox, and W. A. Zisman. Mar. 15, 1950. 22p. (NRL-3651)

Methods of preparing surfaces of polytetrafluoroethylene (TFE) are described which permit obtaining reproducible and reliable measurements of contact angles with liquids. TFE is found to be an ideal low-energy surface for the study of the wetting relations of a solid with a wide variety of organic and inorganic liquids. It is shown that all but the lowest-boiling liquids studied do not adsorb on TFE sufficiently from the vapor to produce a significant spreading pressure. Hence the equilibrium spreading-pressure term in the expression for the work of adhesion, W_A, is negligible, and $W_A = \gamma_{LV}(1 + \cos\theta)$, where γ_{LV} is the free surface energy of the liquid in a vapor. The calculated values of W_A are found to be consistent and reasonable. It is found that for each homologous series of liquids, $\cos\theta$ is a linear function of γ_{LV}. The constants of resulting relations are given. From this $W_A - W_c$, the work of cohesion, can be expressed as a function of γ_{LV} alone. The observations show that there is a critical surface tension (17.5 to 20.5 dynes/cm) below which liquids wet TFE. It is concluded that the Young-Dupré relation coupled with the spreading coefficient permits a rational description of the results. The Doss and Rao relation for the surface condensation leads to such high values for high-boiling liquids as to make it unlikely that the theory is correct.

ANALYTICAL PROCEDURES

44

AMPEROMETRIC TITRATION OF FLUORIDE WITH LEAD. Henry G. Petrow and Leonard K. Nash. Anal. Chem. 22, 1274-7(1950) Oct.

The amperometric titration of fluoride ion with lead, in a solution of 0.1M chloride ion, is described. Lead chlorofluoride precipitates smoothly if the pH of the solution falls in the range 5.5 to 6.5 and if the ionic strength of the solution is not excessive. The difficult separation of this fairly soluble precipitate from its mother liquor is completely avoided. Simple equipment is sufficient, thermostating is unnecessary, the solutions need not be deaerated, small concentrations of anions other than sulfate do not interfere, and the complete determination takes less than 1 hr. Under favorable conditions the results are accurate to a few tenths of 1%. (auth)

45

Chemical Research Laboratory (Teddington)
CHEMICAL PROCEDURES FOR THE DETERMINATION OF THORIUM IN MINERALS AND ORES. A. F. Williams. Feb. 1949. 6p. (CRL-AE-47)

The principal chemical methods at present in use at the Chemical Research Laboratory, Teddington, England for the determination of thorium in a wide variety of minerals and ores are presented. The method for decomposition of the ore has been standardized for most ores, including very refractory types. A procedure based on the use of m-nitrobenzoic acid is included for the precipitation and separation of thorium. This procedure has been extensively used and, under the conditions described, gives accurate results. The methods are suitable for the determination of thorium from a concentration of about 0.1% ThO_2 in the original ore up to practically pure thorium oxide (thorianite).

46

DETERMINATION OF FLUORIDE BY ETCHING. H. Amphlett Williams. Analyst 75, 510-21(1950) Oct.

The reactions involved in the etching of glass have been studied with a view to the development of a specific quantitative method for the determination of small quantities of fluoride. Optimum conditions for high sensitivity have been found by trial, and a method capable of detecting 0.1 μg of fluoride ion is described. The reactions which take place under these conditions have been found to comprise the dissolution of silica from the glass by the hydrogen fluoride, and the deposition of hydrated silica through hydrolysis of the silicon tetrafluoride formed, with the production of a matt "etching" and the regeneration of hydrogen fluoride. It is concluded that a process in which the fluoride acts as a catalyst provides no sound basis for quantitative analysis. (auth)

47

DETERMINATION OF SMALL AMOUNTS OF VANADIUM IN STEEL BY PHOTOMETRIC TITRATION. Robert F. Goddu and David N. Hume. Anal. Chem. 22, 1314-17(1950) Oct.

The ferrous sulfate-persulfate method for the determination of vanadium has been improved by a photometric determination of the end point. This results in an increase in the accuracy and precision as shown by analysis of standard steel samples. High results are obtained if the ratio of chromium to vanadium is greater than 10 to 1. If tungsten is separated, other elements common in steel do not interfere. In addition to the determination of vanadium in steel and ferrous alloys, this general procedure should be applicable to other systems where an accurate determination of small amounts of vanadium is required.

48

Chemical Research Laboratory (Teddington)
DETERMINATION OF URANIUM IN ORES AND SOLUTIONS CONTAINING ARSENIC AND SULFATE IONS BY EXTRACTION METHODS. K. C. Overton and A. F. Williams. Jan. 1950. 11p. (CRL-AE-45)

Methods for the determination of uranium in minerals, ores, and other products in the presence of substantial amounts of arsenic and sulfate ions using solvent extraction in combination with solid absorbents are described. Arsenic is retained by introducing an alumina packing in the column in addition to cellulose, whereas effects due to sulfate are avoided by addition of calcium nitrate to the sample before extraction with ether containing 5% nitric acid. Both alumina and calcium nitrate are employed with materials containing arsenate and sulfate. Some experiments have been made on the extraction of uranium in the presence of sulfate and phosphate. (auth)

49

EQUILIBRIUM CORRECTIONS IN GEIGER ANALYSIS. C. Lapointe. Can. Mining Met. Bull. 43, 465-68(1950) Aug.

A method of analyzing uranium ores based on measurements with a Geiger counter is discussed. It is pointed out that ordinarily radioactive elements are in secular equilibrium and adjustments are made on this basis for final results. Milling, water additions, and other operations of refining upset these calculations and bring about a new set of radioactive conditions which must be evaluated if the method is to be effective. The presence of thorium is not taken into account unless a known amount is in a sample.

50

Atomic Energy Project (Canada)
THE ESTIMATION OF RADIOACTIVE STRONTIUM AND OTHER FISSION PRODUCTS IN URINE AND WATER. C. A. Mawson and I. Fischer. [nd.] 20p. (CRM-455)

Methods are described for the estimation of small amounts of Sr^{89} and "mixed fission products" in urine and water. The active material is co-precipitated with calcium oxalate, and the washed oxalate is deposited on counting trays. Mean recoveries of about 87% of added Sr^{89} and fission products have been obtained from 750 ml of urine and 2 liters of water. Various methods for the elimination of calcium from the material to be counted are discussed. (auth)

51

Chemical Research Laboratory (Teddington)
NEW PROCEDURES FOR THE POLAROGRAPHIC DETERMINATION OF METALS; PART I. USE OF PAPER-STRIP SEPARATION AND A SALICYLIC ACID BASE SOLUTION. J. A. Lewis. Mar. 1950. 9p. (CRL-AE-56)

The use of a mixture of sulfuric and salicylic acids as a base solution for polarography has been found to give quantitative waves for each of ten metals. If certain of these metals are present together, there is interference among them, but a paper-strip separation has been developed which eliminates this interference and enables any or all of them to be estimated to an accuracy of ±6%. The metals for which these procedures have been used are iron, vanadium, molybdenum, bismuth, copper, antimony, uranium, lead, cadmium, and titanium. Tin, phosphate, and nitrate should be absent. (auth)

52

NOTE ON THE DETERMINATION OF CHROMIUM IN URANIUM CHROMIUM ALLOYS. J. Haslam and J. Beeley. June 13, 1944. 3p. (BR-441A)

A method has been worked out for the determination of up to 3% chromium in uranium chromium alloys. The method is based on the isolation of the mixed oxides of uranium and chromium, followed by perchloric acid oxidation of the chromium and final volumetric titration of the dichromate produced. (auth)

53

ON THE SEPARATION AND THE DETERMINATION OF TETRAVALENT AND PENTAVALENT VANADIUM. André Morette and Guislain Gaudefroy. Compt. rend. 231, 408-10(1950) Aug. 7. (In French)

A method of determination of V(IV) and V(V) in a mixture of acid solutions is based on the observation that vanadyl hydroxide, although incompletely precipitated from water solutions, is quantitatively deposited in the presence of acetone (50% acetone concentration). By using $NaHCO_3$, a precipitate is obtained containing vanadyl hydroxide (tetra-

valent V) and sodium vanadate (pentavalent V). The titration is done by reducing with ferrous sulfate, using barium diphenylamino-sulfonate as indicator (Ducret, Anal. chem. acta 1, 135(1947)); this determines V(V). The mixture is then oxidized with potassium persulfate and titrated again; the difference gives the V(IV) content.

54

RADIOMETRIC TITRATION WITH RADIOACTIVE SILVER AS END-POINT INDICATOR. Alois Langer. Anal. Chem. 22, 1288-90(1950) Oct.

Radiometric titrations were extended to include some argentometric titrations using radioactive silver as the indicator. A simplification of the titration procedure is described in which only two points on a branch of the titration curve are determined. The possibility of a radioactive exchange method for determining the amount of a given precipitate is discussed. Radioactive bromine was used as a tracer in the investigation of this titration.

55

A RAPID METHOD OF SEMIMICRO-COLORIMETRIC DETERMINATION OF LITHIUM IN MINERALS AND ORES. V. A. Nazarenko and V. Ya. Filatova. Zhur. Anal. Khim. 5, 234-8(1950). (In Russian)

A semimicro-colorimetric procedure for rapid determination of lithium in minerals and mixtures is described, which is based on the use of the periodate reaction (Proč and Uzel, Mikrochim. acta 3, 105(1938)). Lithium is precipitated from an alkaline solution as $LiKFeIO_6$; the precipitate is dissolved in HCl; Fe is determined in the solution by the thiocyanate method, and Li is calculated from the Fe content. In a 50 mg sample, as little as 0.02% lithium can be determined with a possible error of 10 to 20%.

56

SEPARATION OF THORIUM FROM THE CERIA EARTHS AND ITS APPLICATION TO THE ANALYSIS OF MONAZITE. M. Venkataramaniah and Bh. S. V. Raghava Rao. Analyst 75, 553-4(1950) Oct.

Thoria can be separated from the ceria earths in ratios up to 1:16 by a single precipitation with sodium naphthionate in nearly neutral solution. The minimum amount of thoria that can be satisfactorily determined is about 9 mg. The method can be used for the determination of thoria in the rare earths obtained from monazite. (auth)

57

USE OF HIGH FREQUENCY TITRIMETER. VOLUMETRIC DETERMINATION OF BERYLLIUM. Kermit Anderson and David Revinson. Anal. Chem. 22, 1272-4(1950) Oct.

A new high-frequency titrimeter using a grid-dip-type oscillator was investigated as an instrumental method for assay of beryllium metal and for determination of beryllium in beryllium oxide and beryllium carbide. The instrument proved to be adaptable to the titration of beryllium ion with sodium hydroxide. This titration furnishes a new example in which the high-frequency titrimeter has served to indicate the end point of a volumetric reaction involving an amphoteric substance. (auth)

FLUORINE AND FLUORINE COMPOUNDS

58

THE FLUORIDES OF NIOBIUM, TANTALUM, TUNGSTEN, AND RHENIUM. H. J. Emeléus and V. Gutmann. J. Chem. Soc., 2115-18(1950) Aug.

Tantalum trifluoride was prepared by the action of hydrogen fluoride on tantalum powder or "tantalum hydride" at 250 to 300°C. Tantalum pentafluoride was formed simultaneously. Niobium, its "hydride," or the impure trichloride ($NbCl_{3-5}$) under similar conditions gave only the pentafluoride. The preparation of pure tungsten dibromide is described. It reacted with hydrogen fluoride at 600°C forming tungsten and its hexafluoride. Rhenium trichloride reacted with hydrogen fluoride forming the metal and only traces of the volatile hexafluoride. Tungsten and rhenium metals were unattacked by hydrogen fluoride. (auth)

59

THE FORMATION OF COMPLEX FLUORIDES. PART I. THE RELATION BETWEEN THE CONDUCTIVITIES OF BORIC, ARSENIOUS, AND ANTIMONIC FLUORIDES AND COMPLEX FORMATION. A. A. Woolf and N. N. Greenwood. J. Chem. Soc., 2200-04(1950) Aug.

The formation of alkali complex fluorides by addition and neutralization reactions in nonaqueous solutions is discussed in relation to the conductivity of the fluorides used as solvents. The specific conductivities of boron trifluoride, arsenic trifluoride, and antimony pentafluoride are $<5 \times 10^{-10}$ (at −120°C), 2.4×10^{-5} (at 25°C), and 1.2×10^{-4} (at 25°C)/ohm/cm, respectively. The possible ionic nature of the double fluorides formed by Group-VB and -VIIB fluorides, including the new compounds $AsF_3.SbF_5$ and $IF_5.SbF_5$, is mentioned, and the viscosities of arsenic trifluoride and antimony pentafluoride are reported. (auth)

60

INFRARED SPECTRUM OF CHLOROFLUOROMETHANE. Earle K. Plyler and Mary A. Lamb. J. Research Natl. Bur. Standards 45, 204-8(1950) Sept.

In order to compare its spectrum with that of other halogenated methanes, the infrared spectrum of chlorofluoromethane has been measured in the gaseous state from 2 to 30 μ. The longest wavelength band was observed at 26 μ. Twenty-five bands have been observed with cells of 5, 60, and 100 cm in length and with gas pressures up to 60 cm of mercury. Nine of the observed bands have been classified as fundamentals, and the remaining bands are attributed to harmonics and combinations. Several bands in the region from 1.5 to 2.5 μ were measured on a high resolution grating instrument, and it was possible to resolve each of seven bands into a series of lines in this region. These bands are located at 1.657, 1.682, 1.700, 1.755, 2.229, 2.287, and 2.436 μ; the separation of the rotational lines is of the order of 2.3 cm^{-1} for these bands. (auth)

61

ORGANIC FLUORO-COMPOUNDS. PART II. THE PREPARATION OF ALKYL 2:4-DINITROPHENYL ETHERS FROM 1-FLUORO-2:4-DINITROBENZENE. W. B. Whalley. J. Chem. Soc., 2241-3(1950) Aug. (See also NSA 4-1955)

The interaction of 1-fluoro-2,4-dinitrobenzene with alcohols in the presence of triethylamine readily furnishes the corresponding 2,4-dinitrophenyl ethers, which are suitable in many instances for the characterization of the alcohols. (auth)

GRAPHITE

62

Fansteel Metallurgical Corp.
TOPICAL PROGRESS REPORT TO NEPA PROJECT; SEPTEMBER 1948 TO MARCH 1950. Ralph Wehrmann. Apr. 20, 1950. 44p. (NEPA-1402)

The purpose of this investigation was to develop a coating which would prevent the oxidation of graphite at elevated temperature in air. A workable method for producing silicon coatings on graphite is described. It involves the vapor-phase reduction of $SiCl_4$ by H_2 at elevated temperature. Good quality coatings 0.010 in. thick afford protection to graphite for several hundred hours in air at 1370°C (2500°F). The best life span obtained was 1176 hr. "As deposited" coatings are essentially silicon. At elevated temperature in air gradual conversion to SiO_2 and SiC occurs. At 1370°C or below, at least a few thousand hours are necessary to complete these reactions. Above this temperature conversion is rapid, and the protective value of the coating rapidly decreases. Probably because of the difference in the coefficients of expansion of silicon and graphite, circumferential cracks develop in the coatings. However, these cracks seldom lead to failure because they rapidly fill with SiO_2. Preliminary observations indicate that the thermal-shock resistance of these coatings is good. The major weakness of the vapor-phase method at the present stage of development is the inconsistent quality of the coatings. The results of extensive x-ray and metallographic analyses of the coating are reported. Attempts to produce silicon coatings by painting or dipping methods or by flame spraying were not successful. No satisfactory method for producing molybdenum silicide coatings on graphite was developed. (auth)

63

ON THE SYMMETRY OF GRAPHITE. Joseph S. Lukesh. Phys. Rev. 80, 226-9(1950) Oct. 15.

X-ray diffraction evidence indicates that the symmetry of graphite can be no higher than twofold. Evidence consists of twin observations and the occurrence of satellite reflections, both of which are incompatible with sixfold symmetry. Both phenomena strongly suggest that the classical concept of equivalent C – C bonds must be discarded in favor of one involving unequal bond lengths and bond angles. (auth)

RADIATION CHEMISTRY

64

JAFFÉ'S FORMULAE AND RADIATION-CHEMICAL EXPERIMENTS. John Read. Brit. J. Radiology 23, 621(1950) Oct. (Correspondence)

The formulas of Jaffé (Ann. Physik 42, 303(1913)) giving a distribution function for the number of ions or radicals per unit volume at a distance r from the track of an ionizing particle have been used in several recent discussions of radiation-chemical changes in liquids. It has been assumed that the distribution is always Gaussian. Since it is evident that if recombination proceeds more rapidly in the neighborhood of r = 0, the distribution will become platykurtic, this assumption is legitimate only if diffusion dominates recombination. The compatibility of Jaffé's equations with this requirement has been examined for the distribution of H and OH radicals, using the data of Lea (Brit. J. Radiology 20, Supplement No. 1, 59(1947)). The application of Jaffé's formulas to the ionization produced by x irradiation is found to be valid, but the distribution due to α rays is far from Gaussian, owing to the rapid recombination of the highly concentrated ions.

RADIATION EFFECTS

65

ACTION OF X-RAYS ON AQUEOUS SOLUTIONS OF PYRUVIC AND LACTIC ACIDS. Salvatore Di Bella. Boll. soc. ital. biol. sper. 25, 1268-9(1950) Sept.-Oct. (In Italian)

Forssberg (Nature 159, 308(1947)) has shown that the inhibitory action of x-rays on the function of the catalase ferment can be modified by the presence of various substances. According to his interpretation, x-rays decompose water and the H atoms thus formed act detrimentally on the ferment; if, however, pyruvic acid is present, it removes H by reacting with it and forming lactic acid. This interpretation was not confirmed by the present author's experiments. By direct irradiation (12,000 r) of aqueous solutions, he found that pyruvic acid, although undergoing chemical changes under the influence of x-rays, does not produce lactic acid, while lactic acid is transformed into pyruvic acid.

66

CHEMICAL ACTION OF IONIZING RADIATIONS ON STEROID COMPOUNDS. SUBSTANCES PRODUCED BY THE ACTION OF X-RAYS ON CHOLESTEROL AND ON Δ^5-PREGNENE-OL-ONE IN AQUEOUS SYSTEMS. Joseph Weiss and Max Keller. Experientia 6, 379(1950) Oct. 15. (Brief report)

From x-irradiated aqueous solutions of water-soluble derivatives of cholesterol, cholestane-3(β),5(α),6(β)-triol and Δ^5-cholestene-3(β)-ol-7-one have been isolated. Allopregnane-3(β),5(α),6(β)-triol-20-one has been isolated from irradiated solutions of Δ^5-pregneneolone. These substances are formed in good yields. The results may be of general interest because of the importance of sterols and steroid hormones in cell metabolism.

67

SPLITTING OF MACROMOLECULES OF NATURAL COMPOUNDS UNDER THE ACTION OF γ RAYS. M. A. Khenokh. Zhur. Obshcheĭ Khim. 20, 1560-7(1950) Sept. (In Russian)

The biologically and therapeutically important question of the chemical action of γ rays on natural organic compounds was investigated, using sols of certain carbohydrates with high molecular weights, and solutions of certain sugars. It was found that the irradiation (by γ rays from $RaBr_2$) of a solution of glucose does not notably affect the latter's reducing power, that the oxygen bridge in the maltose mole-

cule undergoes a splitting, and that, under the oxidizing action of the rays, acids are formed in solutions of glucose and maltose. In starch sols the appearance of a reducing power, and a decrease of the viscosity and the pH are observed; there occurs a splitting of the glycoside bonds in the macromolecules, accompanied with a formation of acids and dextrin-like products. In insulin the irradiation causes the splitting of oxygen bridges 1,2 in the chain, and changes in the fructose link shown by the appearance of acids and aldehydes. In agar-agar and gum-arabic sols γ rays produce irreversible chemico-colloidal changes, such as decreases in pH and viscosity, and increase of the reducing power. (auth)

SEPARATION PROCEDURES

68

DIFFUSION AND FLOW OF GASES AND VAPOURS THROUGH MICROPORES. I. SLIP FLOW AND MOLECULAR STREAMING. P. C. Carman. Proc. Roy. Soc. London 203A, 55-74 (1950) Sept. 7.

The transition to molecular streaming of the flow of gas through a porous solid and flow by surface diffusion have been studied with H_2, air, CO_2, and CF_2Cl_2 and compressed plugs of various powders. It has been shown that the slight minimum found in the plot of G, a transport function, versus p, the mean pressure, for circular capillaries is very much exaggerated for noncircular cross sections. Since the pore system in a porous medium must correspond to noncircular sections, a similar minimum might be expected. Such a possibility would give rise to considerable uncertainty in applying gas permeabilities to the determination of specific surfaces of very fine powders, where flow takes place mainly by molecular streaming. It has been established clearly that, while the plot of G versus p sometimes undergoes a small and very gradual change of gradient in the transition region, no sign of a minimum has been detected. For all practical purposes, it is sufficient to assume that G versus p is linear for all values of p. These conclusions are not dependent on porosity or pore texture. The pore texture of fine powders at high porosities is so nonuniform that the surface calculated from permeability is 50% or less of its true value, but the transition from slip flow to streaming is unaffected.

69

MATHEMATICAL ASPECTS OF THE COUNTERCURRENT SEPARATION PROCESSES. Peter Karlson and Erich Hecker. Z. Naturforsch. 5b, 237-46(1950) July-Aug. (In German)

While the theory of simple countercurrent separations is known, more complicated cases resist a mathematical treatment. Formulas, convenient for practical use, are derived, permitting a theoretical computation of the processes. Various applications are discussed and the results are compared with experimental data. (auth)

70

ON THE DETECTION OF HIGHER-ORDER MOLECULES IN MIXTURES OF DILUTE WATER SOLUTIONS OF ELECTROLYTES AND ON A NEW SEPARATION EFFECT. Hans Tolbert. Z. physik. Chem. 195, 237-43(1950) July. (In German)

In a work on the structure of molecules of composite salts in a solution, a short description is given of a separation effect observed in laminary streams. A solution of $ZnSO_4$ in HCl was forced, under a pressure of 2 atm, through a 172-cm long capillary 0.75-mm ID; the density of the central portion of the outcoming solution was higher than that of the peripheral portion.

71

ON AN ION EXCHANGE RESIN. Mario Pedinelli and Franco Bovelacci. Chimica e industria (Milan) 32, 110-15 (1950) March. (In Italian)

Properties are described of a new cation-exchange resin, fabricated in Italy under the name of Decation K-1. It is prepared by a condensation of an alkali p-oxyphenylsulfonate with trioxymethelene.

72

SEPARATION OF LANTHANONS BY MEANS OF COMPLEXES WITH AMINO-ACIDS. R. C. Vickery. J. Chem. Soc., 2058-61(1950) Aug.

The formation of complexes by amino acids with the lanthanons affords an effective method of separating the lighter earths by oxalate fractionation but has little effect on the heavy lanthanons. Of the amino acids studied, histidine forms the strongest complexes, glycine being less efficient; other amino acids are of but little value. Rapid separation of lanthanum is obtained, as well as speedy concentration of samarium; some separation of praseodymium and neodymium is also observed. Indications have been found of the possible existence of two stages of coordination with the amino acids, and some crystalline lanthanon-amino acid complexes have been prepared and analyzed. (auth)

73

Chemical Research Laboratory (Teddington)
A SOLVENT EXTRACTION PROCEDURE FOR THE QUANTITATIVE SEPARATION OF PHOSPHORIC ACID FROM SOLUTIONS CONTAINING METAL SALTS. F. H. Cripps. Mar. 1950. 9p. (CRL-AE-49)

A procedure developed for the separation of phosphate and used in the analysis of phosphatic materials containing thorium has been extended to other metallic constituents containing this radical. The method depends on the solubility of phosphoric acid and sulfuric acid in ether in absence of water. The degree of extraction of phosphoric acid by this method has been determined, and the solubility of a number of the common metals in this process has been investigated. The results of quantitative tests with iron, nickel, potassium (using K^{42} as a tracer), and calcium (using Ca^{45} as a tracer) are presented. It is considered that the method is applicable to the separation of phosphate from a wide range of mixtures in a rapid and convenient manner.

74

THERMAL SEPARATION OF GASES UNDER HIGH PRESSURE. Erwin Willy Becker. Z. Naturforsch. 5a, 457-65 (1950) Aug. (In German)

The pressure dependence of the thermodiffusion factor α for several pairs of gases was measured. Using equimolecular mixtures at about 84°C, it was found that, in the pressure range 3 to 80 atm, α increases for CO_2/H_2 from 0.32 to 0.98, for CO_2/N_2 from 0.05 to 0.40, for CO_2/A from 0.03 to 0.25, for CO_2/CH_4 from 0.07 to 0.37, and for N_2/H_2 from 0.35 to 0.44. On the other hand, N_2/CH_4 and N_2/NH_3 show a reverse relationship: thus, in the last named pair α changes sign at as low a pressure as 1.8 atm. For CO_2/H_2, the dependence of α on both the temperature and the concentration has different signs at 2 atm and at 47 atm. If follows from theoretical considerations that the behavior of the pressure factor in thermal separations of gases is determined chiefly by the properties of real gases and, consequently, can be described by the equation of state. The influence of real-gas properties on the thermodiffusion effect is discussed. (auth)

75

THERMODYNAMIC PROPERTIES OF ISOTOPIC COMPOUNDS OF SULPHUR. A. P. Tudge and H. G. Thode. Can. J. Research 28B, 567-78(1950) Sept.

Using the well-known methods of statistical mechanics, partition-function ratios for many isotopic sulfur compounds have been calculated. These partition-function ratios are used to determine equilibrium constants for many possible exchange reactions involving the isotopes of sulfur. The results indicate that considerable fractionation of the sulfur isotopes can be expected in laboratory and natural processes. The predicted exchange constants are discussed in the light of recent results on the distribution of sulfur isotopes in nature. (auth)

SORPTION PHENOMENA

76

MEASUREMENT OF THE ADSORPTION OF SURFACE-ACTIVE AGENTS AT A SOLUTION/AIR INTERFACE BY A RADIOTRACER METHOD. D. J. Salley, A. J. Weith, Jr., Ann A. Argyle, and J. K. Dixon. Proc. Roy. Soc. London 203A, 42-55(1950) Sept. 7.

The adsorption of a water-soluble surface-active agent at the solution-air interface has been measured by taking advantage of the soft β radiation from the radioactive isotope of sulfur, S^{35}. The method depends on the fact that, because of "self-absorption" of the radiation by the solution, and because the molecules of a surface-active agent are preferentially adsorbed at the interface, the radioactivity above a solution containing such an agent labeled with radiosulfur should be higher than that from a solution in which no surface adsorption occurs. Carefully purified di-n-octyl sodium sulfosuccinate and sodium sulfate were each synthesized with S^{35}. Measurements on solutions of these showed that the radiotracer technique permitted a successful quantitative determination of the adsorption. Counting rates over the solutions of agent were 1.1 to 20 times those of the corresponding sodium sulfate, and for 29 different solutions covering a range of specific activities (1×10^{12} to 5×10^{9})cpm/mole) and of concentrations (0.1×10^{-3} to 150×10^{-3} mole/ml) a well-defined adsorption isotherm resulted. (auth)

SPECTROSCOPY

77

ON THE X-RAY LUMINESCENCE SPECTRA OF ALKALI HALIDES. Aparesh Chatterjee. Indian J. Phys. 24, 265-70(1950) June.

The x-ray luminescence spectra of a few alkali halides (NaF, NaCl, NaBr, KBr, KI) have been reported in this paper. The pure crystals become colored due to new absorption bands created on irradiation. The emission bands are not characteristic of any impurities present, and hence they represent lattice emission. The importance of lattice emission spectra in elucidating the electronic energy states of solids is discussed. (auth)

SYNTHESES

78

STUDIES ON NIOBIUM AND TANTALUM. PART III. TARTRATONIOBATES OF ALKALINE EARTH AND OTHER METALS. N. R. Srinivasan. Proc. Indian Acad. Sci. 31A, 381-8(1950) June.

The niobates of the alkaline earth and other metals are insoluble and hence the tartratoniobates of these metals are prepared by double decomposition of soluble metal salts with potassium tartratoniobate. The calcium-2-tartrato-2-niobate-10-hydrate of the formula $CaO.Nb_2O_5.(C_4H_4O_5)_2.10H_2O$ has been prepared and studied. The strontium tartratoniobate prepared has the formula $SrO.Nb_2O_5.(C_4H_4O_5)_2.10H_2O$. A copper compound of the formula $CuO.Nb_2O_5.(C_4H_4O_5)_2.10H_2O$ has been prepared in a similar manner. The barium and lead tartratoniobates are also prepared by the foregoing method of double decomposition but they are obtained as basic salts of the formulas $4BaO.3Nb_2O_5.(C_4H_4O_5)_2.16H_2O$ and $5PbO.3Nb_2O_5.(C_4H_4O_5)_2.20H_2O$. It is significant that the dehydration of the barium salt gives a practically anhydrous compound. The calcium, strontium, and copper compounds obtained are considered as the normal salts of the 2-tartrato-2-niobic acid whereas those of barium and lead are regarded as basic salts. Suitable heteropoly acid structures are assigned to these compounds. (auth)

79

SYNTHESIS OF 2-ACETYLAMINOFLUORENE-9-C^{14} AND 2-ACETYLAMINOFLUORENE-ω-C^{14}. Francis Earl Ray and Robert C. Geiser. Cancer Research 10, 616-19(1950) Oct.

As a preliminary to the study of the metabolism of 2-acetylaminofluorene in its relation to chemical carcinogenesis, C^{14} was incorporated into the 9 position of this compound as previously reported (see NSA 2-2094). The synthesis is repeated in detail. In addition, since it seems probable that the acetyl group is removed at an early stage of metabolism, 2-acetylaminofluorene-ω-C^{14}, labeled in the methyl group of the side chain, has been synthesized.

TRACER APPLICATIONS

80

ISOTOPIC EXCHANGE BETWEEN COBALT AND TANTALUM AND THEIR IONS IN SOLUTION. Maurice Cottin. Compt. rend. 231, 697-9(1950) Oct. 9. (In French)

The exchange between passive or easily rendered passive metals and their ions in solution has been little studied to date. The behavior of mechanically or electrolytically polished sheets of cobalt in solutions of chloride, sulfate, nitrate, acetate, and perchlorate ions, and of tantalum in hydrofluoric ion, has been investigated with Co^{60} and Ta^{182} as tracers. With tantalum, the exchange was zero or at least of lower velocity than dissolution. The exchange of cobalt with its ions was slow, but the effects of solution, temperature, and nature of the surface were distinguishable and are discussed qualitatively.

81

A STUDY OF DIAZO-COMPOUNDS BY USE OF NITROGEN ISOTOPES. Part I. The Structure of the Diazonium Ion. P. F. Holt and B. I. Bullock. J. Chem. Soc., 2310-11(1950) Sept.

The nonequivalence of an absence of interchange between the nitrogen atoms of a diazonium ion have been demonstrated by diazotizing N^{15}-labeled aniline, coupling the diazonium salt, and regenerating the aniline by reduction of the azo compound. (auth)

82

Carnegie Institute of Technology

THE VAPOR PRESSURE OF SILVER. H. M. Schadel, Jr., and C. E. Birchenall. May 31, 1950. 23p. (NP-1726)

The vapor pressure of silver has been determined in the temperature range 1023.6 to 1323.8°K by use of the orifice-effusion technique and tracer Ag^{110}. The collimated atomic beam was condensed on a target, and the weight of silver was radiometrically determined with a G-M counter. From these measurements and data of other investigators the vapor pressure curve has been calculated for both solid (1023.6 to 1233.5°K) and liquid (1233.5 to 2443.5°K) silver. All data used have been checked thermodynamically by determining the consistency of the heat of vaporization at absolute zero as calculated from the experimentally determined vapor pressures and accepted heat capacities, entropies, and heats of fusion.

TRANSURANIC ELEMENTS AND COMPOUNDS

83

TRANSURANIC ELEMENTS. G. B. Gazzaniga. Scienza e lavoro 5, 381-4(1950) July. (In Italian)

An elementary note on nuclear phenomena and the discovery of transuranic elements is presented.

84

THE TRANSURANICS AND OTHER NEWLY DISCOVERED ELEMENTS. H. J. Emeléus. Science Progress 38, 609-21(1950) Oct.

A general, but rather brief, review is presented of the discovery, production, and chemistry of technetium, promethium, astatine, francium, and the transuranic elements. No references to original papers are given.

TRITIUM

85

TRITIUM CONTENT OF THE ATMOSPHERE. V. Faltings and P. Harteck. Z. Naturforsch. 5a, 438-9(1950) Aug. (In German)

Enriched free hydrogen of the atmosphere revealed the presence of tritium through the latter's β activity. T is probably generated (together with He^3) through the disintegration of various nuclei of atmospheric gases by cosmic radiation in high altitudes. Since in these regions H_2O is photochemically decomposed into atoms, T combines with H into HT which is carried down by convection and diffusion. The authors separated hydrogen from the He-Ne fraction obtained during the production of liquid air, oxidized it into water over CuO, reduced the water volume electrolytically so as to increase the T concentration about 20-fold, and converted the water into ethane by reaction with acetylene. It was calculated from the β activity of the product that there is about 1 atom of T in 10 cc of air, or only 1 mole in the whole atmosphere.

URANIUM AND URANIUM COMPOUNDS

86

ABSORPTION SPECTRA OF THE SODIUM PERURANATES. T. V. Arden and Patricia McGlone. Nature 166, 560-1 (1950) Sept. 30. (Letter to the editor)

The presence of bicarbonate in solutions of sodium peruranate formed by the addition of excess hydrogen peroxide to sodium uranyl tricarbonate solution causes errors in the absorptiometric determination of uranium. The absorption spectra of solutions of uranium trioxide in sodium carbonate and excess sodium hydroxide, in sodium carbonate, in equal quantities of sodium carbonate and sodium bicarbonate, and in sodium bicarbonate, a large excess of hydrogen peroxide being present in each case, have been determined, It is shown that the changes in the absorption spectra are due largely to changes in proportions of the three peruranates, Na_2UO_4, Na_4UO_5, and $Na_2U_2O_{10}$, the effect of absorption by $Na_4UO_2(CO_3)_3$ being relatively unimportant.

87

POSSIBLE f-SHELL COVALENCY IN THE ACTINIDE ELEMENTS. Leonard I. Katzin. Nature 166, 605(1950) Oct. (Letter to the editor)

Arguments are presented to show that the coordination of nitrate by uranyl ion is neither unique nor different in kind from that found lower in the periodic table, and in particular in a transition element such as cobalt.

88

ON THE FORMATION OF THE COMPLEX $[UO_2(NO_3)_2C_2H_{12}O_2N]_n$. Colette Soye. Compt. rend. 231, 349-50(1950) July 31. (In French)

The formula d pH/d log V = const (Bye, Bull. soc. chim. France 9, 360(1942); Souchay, ibid. 1, 22(1949)) was applied to the study of condensation products formed in mixtures of aqueous solutions of chlorine and uranyl nitrate. It follows from this formula, (in which V is the dilution degree), that the slope of the straight line pH = f(log V), plotted at neutralization points, depends on the degree of condensation only. By observing the change in the slope of lines obtained for various relative contents of chlorine, information is gained on the formation of complex compounds. It was found that in some concentration ranges the lines become parallel 48 hr or more after the neutralization. In solutions containing ¼ to 1 equivalent of chlorine per 1 equivalent uranyl nitrate in a M/160 solution, the compound $[UO_2(NO_3)_2 \cdot C_5H_{15}O_2N]_n$ is formed, a condensation product previously isolated by the author (Compt. rend. 228, 1228(1949)).

89

Imperial Chemical Industries, Ltd.
THE VAPOUR PRESSURE OF SOLID HEX. J. H. Awbery. Oct. 4, 1943. 2p. (BR-302)

Results of the discussion indicate the following: the vapor pressure of pure solid UF_6 is best represented by the equation $\log p = 10.74319 - 2593.48/T$; the melting point is 64.45°C; the sublimation point is 56.76°C; and the vapor pressure at the ice point is 17.65 mm. (T = temperature measured from −273.10°C.

ENGINEERING

HEAT TRANSFER AND FLUID FLOW

90

University of Chicago Metallurgical Laboratory
TEMPERATURE RISE UNDER A RIB. W. Karush and G. Young. Dec. 22, 1943. Decl. Oct. 17, 1950. 11p. (AECD-2958; CP-1172; A-1653)

In the theoretical problem of a coated object, upper and lower bounds for a temperature rise are obtained and, with results obtained previously, give an adequate solution of the problem. In the uncoated problem, upper and lower bounds are also obtained. The object is treated as a semi-infinite slab; this assumption is discussed and validated. (auth)

91

University of Chicago Metallurgical Laboratory
FLOW OF HEAT INTO COATING THROUGH A NARROW STRIP. W. Karush and G. Young. Feb. 29, 1944. Decl. Oct. 16, 1950. 5p. (AECD-2959; CP-1378; A-2019)

The theoretical problem considered is that of a cylinder, with internal heat generation, cooled at its outer radial surface through a thin conducting coating and covered on its ends by thin conducting disks through which heat is conducted radially to the cylindrical surface. Owing to these end discs the coating will carry an extra thermal load at the area of junction between the disks and the coating. The extra heat flow through, and temperature rise in, the coating are the subject of the calculations. Two solutions of a problem of this kind are given, one exact and one approximate.

92

University of Chicago Metallurgical Laboratory
TEMPERATURE RISE IN A PITTED SURFACE. W. Karush. Aug. 2, 1944. Decl. Oct. 17, 1950. 6p. (AECD-2961; CP-1964; A-2841)

Formulas for the temperature rise in the neighborhood of a pit in a heat transfer surface are obtained for three shapes of pit: sphere, oblate ellipsoid of revolution, and prolate ellipsoid of revolution.

93

University of Chicago Metallurgical Laboratory
THE EFFECT OF DRAWING OFF HEAT ON ONE SIDE OF A CORNER. W. Karush. Aug. 18, 1944. 9p. (AECD-2962; CP-2072; A-3014)

The problem of the harmonic temperature field in a quarter-infinite solid bounded by two perpendicular planes in which the rate of heat flow out one face is a prescribed function, while the flow out the other face is given by hT, where h is a constant heat-transfer coefficient and T is the temperature of the surface of the solid, is considered. The special case $h = \infty$, i.e., $T = 0$, is treated separately.

94

University of Chicago Metallurgical Laboratory
TEMPERATURE RISE UNDER UNCOOLED AREAS OF THIN PLATES. William Karush. Jan. 25, 1945. Decl. Oct. 16, 1950. 8p. (AECD-2963; CP-2663)

Uncooled areas on one or both sides of a plate are considered, and the temperature rise for circular areas and long rectangular areas is calculated approximately.

95

University of Chicago Metallurgical Laboratory
THERMAL CONDUCTIVITY OF A SEMI-INFINITE SLAB WHEN THE FLOW TO AND FROM THE SLAB CROSSES THE SURFACE NEAR THE EDGE. F. H. Murray. Mar. 17, 1944. Decl. Oct. 16, 1950. 4p. (AECD-2965; CP-1486; A-2069)

Thermal contact with a semi-infinite slab is made along a strip next to the boundary. The thermal conductivity of this configuration is computed and expressed in terms of the conductivity of the strip alone separated from the remaining part of the slab.

96

University of Chicago Metallurgical Laboratory
TEMPERATURE OF TWO METALS IN CONTACT. W. Karush. Dec. 22, 1944. Decl. Oct. 16, 1950. 8p. (AECD-2967; CP-2509)

The temperature at the surface of contact of two metals, across which heat is flowing, is considered analytically under certain idealized conditions.

97

University of Chicago Metallurgical Laboratory
HEAT FLOW FROM A FIN TO A BOILING LIQUID. A. V. Martin. May 11, 1945. 10p. (AECD-2968; CP-2995)

A mathematical analysis is made of the smallest length that a fin can have if it is to dissipate to a boiling liquid 9/10 as much heat as would a fin of infinite length.

98

Gibbs and Cox, Inc.
AN UP-TO-DATE REVIEW OF THE PRINCIPLES OF HEAT TRANSFER, WITH PARTICULAR APPLICATION TO NUCLEAR POWER. Charles F. Bonilla. 1949. 35p. (M-4476)

Principles of heat transfer and related information are considered on a basis of steady-state conduction, and include terminology, conversion factors, differential equations of heat flow, flow through a slab without heat generation, flow through the wall of a concentrically hollow cylinder without heat generation, thermal resistances, Langmuir's approximation method, etc. Heat transfer to fluids, an extended surface method, heat transfer by radiation, unsteady-state heat transfer, and pressure drop considerations are also considered. 48 references.

99

FLOWMETER ERROR IN MEASURING PULSATING FLOW. G. W. C. Tait. Can. J. Research 28F, 333-40(1950) Aug.

Measurement of air flow with variable orifice type flowmeters in laboratory experiments revealed discrepancies that could not be explained as errors arising from faulty calibration, leaks in the system, or failure to reduce readings to standard conditions of temperature and pressure. They were found to arise because of the occurrence of rapid pulsations in the air flow. A theoretical analysis of the effect showed that these instruments indicate root mean square rather than average flow rates. The results of experiments designed to test the theory were in reasonable agreement with the predicted values. It was found that errors arising from the occurrence of pulsations could be minimized by insertion of a suitable smoothing device between the pump and flowmeter. For example, an orifice with a pressure drop of 40 cm of water reduced the flowmeter error to 5% of the true flow rate. (auth)

100

Atomic Energy Research Establishment
HEAT TRANSFER PROPERTIES OF MERCURY. D. English and T. Barrett. June 1950. 26p. (AERE-E/R-547)

Methods for the determination of the heat transfer coefficients of Hg by using Ni or stainless steel tubes heated by heavy alternating currents are described. Values of the heat transfer coefficient are given for a wide range of Reynolds numbers in very small tubes. It was found that Ni was attacked under the conditions used in the experiments while stainless steel proved immune from attack.

101

California Institute of Technology, Jet Propulsion Laboratory
HEAT TRANSFER IN SWEAT-COOLED POROUS METALS; PROGRESS REPORT NO. 1-58. S. Weinbaum and H. L. Wheeler, Jr. Apr. 8, 1947. 18p. (NP-1748)

Solution of the system of differential equations describing heat transfer inside a cylindrical bar during sweat-cooling indicated that for the volume of flow that may be expected during sweat-cooling, temperatures of metal and fluid are indistinguishable throughout the entire volume of porous metal; temperature distribution along the length of the bar is not linear, as in case of a solid metal bar, but dependent upon an exponential term.

102

California Institute of Technology, Jet Propulsion Laboratory
HEAT TRANSFER IN SWEAT-COOLED POROUS METALS; PROGRESS REPORT NO. 1-62. S. Weinbaum and H. L. Wheeler, Jr. July 3, 1947. 21p. (NP-1749)

The physical picture of heat transfer between metal and cooling fluid in a hollow porous metal cylinder, sweat-cooled by a radial flow, is the same as in linear flow of sweat-cooling fluid through a porous metal bar; in both cases the cooling fluid is brought to the temperature of the metal within a very small distance from the surface of entrance of the fluid. Temperature distribution in the radial direction in the metal depends not upon a logarithmic term but upon a fractional power of the radius.

103

California Institute of Technology, Jet Propulsion Laboratory
HEAT-TRANSFER MEASUREMENTS IN NITROGEN SWEAT-COOLED CYLINDER EXPOSED TO RADIATION; PROGRESS REPORT NO. 4-105. Franklin O. Myers. June 24, 1949. 14p. (NP-1753)

An experimental study was made of sweat-cooling of a porous wall exposed to radiation. The apparatus consisted of an electrical resistance type of graphite heating element surrounded by a cylindrical porous specimen which was sweat-cooled with nitrogen. It is concluded that the radiant heat transfer to a surface is not affected by sweat-cooling that surface with a nonluminous gas.

MATERIALS TESTING

104

University of Chicago Metallurgical Laboratory
THERMAL STRESSES AND STRAINS IN A FINITE CYLINDER WITH NO SURFACE FORCES. F. H. Murray. Jan. 9, 1945. 20p. (AECD-2966; CP-2628)

The stresses and strains near the ends of an unheated cylinder with a longitudinal tension applied over the ends is solved by a detailed analysis. For comparison, the problems of a disk (very short cylinder) and of a thin rectangular plate are also solved.

105

National Bureau of Standards
CREEP TEST ON GRAPHITE. R. F. Geller. May 22, 1950. 4p. (NEPA-1427)

Results of tests on uncoated graphite specimens, placement of a ring of cement around a Be_2C specimen for compatibility with gauge materials, and consideration of problems of the sticking of the porcelain parts of the gauge, etc., are reported.

RADIOGRAPHY

106

APPLY RADIOACTIVE-COBALT 60 TO RADIOGRAPHY OF CASTINGS. Herbert R. Isenburger. Am. Foundryman 18, 48(1950) July.

An exposure chart to be used in conjunction with Co^{60} in radiographic tests of steel castings is described and illustrated. Tests with Co^{60} are the basis for the chart. Exposure curves have been established in radium equivalents, the ordinate of the chart including also the time exposure in hours. An illustrative problem is included.

TRACER APPLICATIONS

107

RADIOACTIVE ISOTOPES FOR INDUSTRIAL USE. T. H. Oddie. Roy. Australian Chem. Inst. J. & Proc. 17, 266-9 (1950) July.

A brief discussion of industrial applications of radioisotopes is followed by information as to where prospective Australian users may obtain isotopes and labeled compounds.

MINERALOGY, METALLURGY, AND CERAMICS

CERAMICS AND REFRACTORIES

108

Battelle Memorial Institute
APPARATUS FOR MODULUS OF RUPTURE DETERMINATIONS AT ELEVATED TEMPERATURES. C. G. Harman, J. F. Quirk, and E. C. Hoeman. Mar. 29, 1950. 14p. (NEPA-1383)

Apparatus and a method of testing to determine moduli of rupture of ceramic specimens at temperatures ranging from room temperature to 2500° F are described. The apparatus, which can be operated in oxidizing or protective atmospheres, permits the simultaneous testing of as many as ten specimens. Results of tests to determine the moduli of rupture of sintered carbide compacts at 2500° F indicated that the average deviation from the mean value was 10%. Drawings are included.

109

M. I. T. Department of Metallurgy
EIGHTH INFORMAL MONTHLY REPORT ON DEVELOPMENT OF METAL-CERAMIC COMPOSITIONS SUITABLE FOR SERVICE AT ELEVATED TEMPERATURES.
W. D. Kingery, G. Economos, M. Humenik, Jr., and M. Berg. Mar. 1950. 9p. (NEPA-1391)

Shock mountings have been installed on the sessile-drop induction furnace, and good agreement is now being obtained between two methods of calculation for surface tension. Preliminary data for copper show that on graphite in hydrogen a low value (about 370 ergs/cm²) is obtained. This is thought to be due to solution of graphite in the copper. In a vacuum, a non equilibrium-shape drop forms. When copper is heated in hydrogen and melted in vacuum on alumina, the surface tension decreases with time, indicating that some change in composition may be taking place. Literature data for ceramic metal reactions are reviewed, and preliminary results of tests with nickel and silicon on alumina and zirconia (stabilized) are reported. Some literature data regarding densification in sintering are reviewed. Study of the effect of a metal phase on densification has been initiated. (auth)

110

M. I. T. Department of Metallurgy
NINTH INFORMAL MONTHLY REPORT ON DEVELOPMENT OF METAL-CERAMIC COMPOSITIONS SUITABLE FOR SERVICE AT ELEVATED TEMPERATURES.
W. D. Kingery, G. Economos, M. Humenik, Jr., and M. Berg. Apr. 1950. 6p. (NEPA-1435)

A method of calculating approximate surface energies on simple theoretical grounds is described and sample calculations for copper, lead, and sodium chloride are given. Measurements of contact angles of copper with alumina, stabilized zirconia, and graphite are reported. Values varied considerably between hydrogen and vacuum. Plaques and covers have been prepared from alumina and stabilized zirconia for the study of metal-ceramic reactions. Sodium chloride has been selected as a model material for the study of metal-ceramic sintering. Some spherical particles have been formed. Some preliminary measurements of the effect of forming pressure on green density, and the sintering rate of pressed pieces have been made. (auth)

111

Sintercast Corporation of America
PROGRESS REPORT FOR MAY 1, 1950–JULY 31, 1950.
C. G. Goetzel and R. B. Wagner. Aug. 1, 1950. 13p. (NYO-687)

A literature survey was made on methods for the production of zirconium carbide and on previous work done on cemented zirconium carbide bodies. Initial production runs resulting in the carburization of zirconium oxide, hydride, and metal were performed. The production of zirconium carbide from the oxide and from the hydride were found to be the most favorable methods. Two initial series of cold-pressed, sintered bars of commercial grade of zirconium carbide with 5% nickel were completed. Design activities were commenced on the development of a suitable vacuum or atmosphere hot pressing apparatus.

112

North Carolina State College
THE EFFECT OF THERMAL TREATMENT ON THE

DIELECTRIC PROPERTIES OF CERAMIC BODIES. (TECHNICAL REPORT NO. 1). E. M. Tuttle and H. H. Wilson. June 15, 1950. 53p. (NP-1653)

Three general cases are being studied where (1) a ferroelectric crystal type is formed in different parent glasses, (2) two different parent glasses produce the same crystallization product, and (3) an added component and the crystallization product are similar. This report consists of a survey of the work which has been done during the past year. Preliminary experiments have been completed to ascertain the degree to which the effect of thermal treatment of a glassy media may be reflected in dielectric properties. Glasses were developed which devitrify to form sodium metatantalate. The rate of growth of the sodium metatantalate was determined by the fragment method to give an approximate curve. The ability of these crystals surrounded by glass to show ferroelectric properties was investigated by measuring the dielectric constant of the material from room temperature to 500°C. The dielectric constant and power factor were determined for a soda-lime-silica glass which was heated for various periods of time at its temperature of maximum rate of crystal growth. 41 references.

113

Alfred University
MECHANISM OF CERMET OXIDATION AT HIGH TEMPERATURES. W. B. Crandall, H. S. Levine, G. E. Lorey, and V. D. Frechette. Oct. 1, 1950. 12p. (NP-1763)

Among the many factors that determine the usefulness of a metal-ceramic mixture is its resistance to oxidation in air at high temperatures. The mechanism of oxidation of cermets is not well known. It was the purpose of this investigation to evaluate each of the variables which affects the oxidation rate of cermets, and to establish a general mechanism by which oxidation proceeds. The progress of oxidation was followed by observing (1) the rate of penetration of an oxide layer into the cermet body, and (2) the weight gain as a function of time during exposure to air at temperatures from 600 to 1000°C. Dispersed binary mixtures of Co and Al_2O_3 were taken as a model system and extensively studied by these two types of experiments with metal concentration, porosity, and temperature as variables. These studies were supplemented with weight-gain experiments on binary mixtures of the metals Fe, Co, and Ni with the oxides Al_2O_3, BeO, Cr_2O_3, ZrO_2, and MgO. It is concluded that the progress of oxidation in a cermet body is controlled by the rate of change of oxygen concentration in the pore structure of the cermet body. The porosity, metal concentration, temperature, oxidation state and oxidation rate of the metal, and diffusion rate of oxygen are variables which influence the oxygen concentration change.

114

California Institute of Technology, Jet Propulsion Laboratory
A STUDY OF CERAMIC LINERS FOR UNCOOLED ROCKET MOTOR CHAMBERS. Leroy C. Land. Oct. 1, 1948. 45p. (NP-1752)

Zirconia, zircon, silicon carbide, and beryllia were tested as liners in a water-cooled, liquid-propellant, 750-lb-thrust rocket motor. For over-all performance stabilized zirconia was the best liner tested. It is concluded that ceramic liners for the chambers of uncooled rocket motors of short duration (less than 220 sec) are feasible with liquid propellants that develop chamber temperatures up to about 5000°F.

GEOLOGY AND GEOPHYSICS

115

RADIOACTIVITY IN ONTARIO. Mining Mag. 83, No. 1, 61-2(1950) July.

A report based on information from the Ontario Department of Mines discusses the radioactivity and geology of an area on the east shore of Lake Superior about 70 miles north of Sault Ste. Marie. The pitchblende type of radioactive deposits in this area differ from the granite type with respect to age, method of formation, mineral composition, and economic interest. At the present time the pitchblende deposits offer the better prospecting possibilities. The discussion in the report indicates that diabase dykes are the best prospecting possibilities. In areas covered by overburden the dykes can often be traced both on the ground and with the aid of aerial photographs, as shallow valleys or by the persistence of prominent granite faces. Magnetometer surveys to locate dykes will prove useful except in areas of granite that contain large numbers of pre-Algoman inclusions.

METALS AND METALLURGY

116

American Smelting and Refining Co.
PROGRESS REPORT NO. 1; JUNE 15, 1950, TO SEPTEMBER 15, 1950. J. L. Everhart and E. L. Van Nuis. Sept. 29, 1950. 7p. (NYO-760)

Experimental work on the development of low-melting alloys based on bismuth, indium, lead, tin, and thallium has continued during the past quarter. Static corrosion tests of various steel-alloy construction materials exposed to attack by low-melting alloys for 500 hr at 1200°F are reported. The polished and etched exposed samples are corrosion rated by comparison with a set of microphotographic standards. Dynamic (slow circulation) corrosion tests are in progress. The volumetric changes in the bismuth-lead eutectic alloy on freezing and cooling to room temperature have been determined with a volumetric dilatometer.

117

AGING CHARACTERISTICS OF MAGNESIUM-LITHIUM BASE ALLOYS. P. D. Frost, J. G. Kura, and L. W. Eastwood. J. Metals (N.Y.) 188, 1277-82(1950) Oct.

Although magnesium-lithium base alloys have several desirable properties, they also possess certain undesirable characteristics, one of which is the tendency to over age at 150° to 200°F. This problem is discussed in the paper. Recently developed alloys, described in the paper, have stability of properties at 200°F nearly equal to that of commercial magnesium alloys. (auth)

118

THE APPLICATION OF CHEMICAL THERMODYNAMICS TO THE STUDY OF METALLIC ALLOY FORMATION. QUARTERLY PROGRESS REPORT FOR APRIL 1, 1950-JULY 1, 1950. R. S. Craig, W. E. Wallace, T. M. Buck, D. A. Edwards, E. E. Ketchen, C. B. Satterthwaite, and F. A. Trumbore. July 3, 1950. 9p. (NYO-606)

Continuation and status of work on the investigations of the heat of formation of Na-K and Cd-Mg alloys are reported. Heat of formation studies and free energies of the formation of Cd-Mg alloys are considered. Specific heat studies (Cd-Mg system) and the apparatus, calibration, preparation of sample, etc., are described. Data are tabulated.

119

THE CONSTITUTION OF URANIUM-MOLYBDENUM ALLOYS. P. C. L. Pfeil. J. Inst. Metals 77, 553-69 (1950) Aug.

The uranium-molybdenum system has been examined experimentally, using micrographic, x-ray, and thermal-analysis methods. No intermediate phases were recognized in this system. As predicted, the solid solution of molybdenum in γ-uranium is relatively extensive, and is in equilibrium with a molybdenum-rich solid solution containing a small quantity of uranium. With approximately 19 at. % molybdenum the body-centered cubic modification is stabilized down to room temperature. The γ phase can be retained down to room temperature by quenching alloys containing above approximately 9 at. % molybdenum, but with lower molybdenum contents decomposition to α by a martensitic type of reaction occurs. The solid solubility of molybdenum in β-uranium is restricted, while that in the α modification is intermediate between that in the β and γ modifications. This leads to a direct transformation between γ- and α-uranium, not involving the β phase, in alloys containing more than 2 at. % molybdenum. The $\alpha/(\alpha + \gamma)$ phase boundary falls to room temperature with increasing molybdenum contents. The experimental results, particularly the solid solubility of molybdenum in the three allotropic modifications of uranium, are discussed in terms of the general theory of the alloying behavior of uranium. (auth)

120

THE DETERMINATION OF THE VISCOSITY OF MOLTEN METALS. M. R. Hopkins and T. C. Toye. Proc. Phys. Soc. (London) 63, 773-82(1950) Oct. 1.

A method is described for the measurement of the viscosity of molten metals at temperatures up to about 900°C. The metal is contained in a cylindrical crucible which is allowed to oscillate about its axis under the control of the torsion in a suspension wire. The theory of the method is considered. The viscosity of zinc has been determined in the temperature range 430°C to 480°C and the results are given. 11 references. (auth)

121

Lewis Flight Propulsion Laboratory
EFFECTIVENESS OF MOLYBDENUM DISULFIDE AS A FRETTING-CORROSION INHIBITOR. Douglas Godfrey and Edmond E. Bisson. Sept. 1950. 29p. (NACA-TN-2180)

The effectiveness of molybdenum disulfide MoS_2 as a fretting-corrosion inhibitor was investigated. Six methods of applying MoS_2 to steel specimens were evaluated by noting the number of cycles of vibration required to produce the first evidence of fretting corrosion and by observing the nature of its occurrence. Experiments were conducted with steel balls vibrating in contact with glass flats whereby the action could be microscopically observed. A coating of dry MoS_2 (bonded to steel by rubbing a mixture of MoS_2 and syrup into intimate contact with the clean steel at elevated temperatures) proved most effective. Of the methods investigated, this coating delayed the start of fretting corrosion of the steel ball to 28,000,000 cycles in contrast to less than 30 cycles for the clean uncoated steel ball. Dry MoS_2 and mixtures of MoS_2 with various carriers (water and aerosol, light oil, and heavy grease) appreciably delayed the occurrence of fretting corrosion. Microscopic observation, however, indicated that MoS_2 may have been ineffective at the contact area and that the carrier alone may have been responsible for the beneficial action. Experiments were also conducted with steel flats that produced fretting corrosion of clean untreated specimens in less than 100 cycles. A bonded coating of MoS_2 was again most effective, delaying the start of fretting corrosion to 10,000 cycles, whereas dry MoS_2 and mixtures of MoS_2 with carriers were less effective. Observations indicated that the effectiveness of any fretting-corrosion inhibitor is dependent on its ability to prevent metallic adhesion continuously.

122

ELECTRODEPOSITION OF METAL POWDERS. Gustaf Wranglen. J. Electrochem. Soc. 97, 353-60(1950) Nov.; Engrs. Digest 11, 355-8(1950) Oct.

Metal powders may be produced electrolytically by two different methods: (a) direct deposition on the cathode, and (b) grinding of a brittle deposit. The principles underlying method (a) are dealt with in this paper. Three factors are shown to be responsible for the formation of powdery or spongy deposits: low metal overvoltage, depletion of the metal content of the cathode film, and hydroxide formation in the cathode film. These factors may operate together or they may be operative under different conditions of electrolysis. Powder formation on the cathode in the electrolysis of copper, iron, nickel, zinc, and cadmium is described and analyzed. (auth)

123

EXPERIMENTS ON THE MECHANISM OF SINTERING. B. H. Alexander and R. Balluffi. J. Metals (N. Y.) 188, 1219(1950) Oct.

The following article is reproduced in its entirety.

By a method similar to that of Geech & Jones (Research 2, 493(1949)) the change in size and shape of the interstices between 5 mil copper wires has been followed as a function of time at various sintering temperatures. It has been found that the initial rate of decrease in the size of these voids is greater the higher the temperature. Upon sintering, the triangular cusp-shaped voids between the wires become circular in cross-section and are connected to each other by grain boundaries. As long as these grain boundaries are present the voids continue to decrease in size. After a length of time, which decreases with in-

creasing temperature, these grain boundaries disappear, and after their disappearance no further decrease in the size of the voids occurs. Because the grain boundaries disappear sooner at higher temperature, the over-all decrease in the size of the voids is smaller, even though the initial rate of decrease is greater, at the higher temperatures.

We have concluded from these experiments that grain boundaries are essential for the sintering of powdered metal compacts, and that the finer the grain size, the more rapidly sintering will occur. A series of experiments on powdered silver compacts is in progress, and it has been found that any treatment which can affect the initial recrystallization, and hence the grain size, of the pressed compacts will change the rate of sintering markedly. The effects of recovery at room temperature, recrystallization at low temperatures, rate of heating, and atmosphere are being studied in silver compacts, and it has been found that all of these can have a pronounced effect on the rate of sintering. An attempt is being made to explain these effects according to variations in grain size of the specimen.

124

GERMANIUM FROM FLUE DUST. GROWING INDUSTRIAL VALUE OF A RARE ELEMENT. A. E. Williams. Chem. Age (London) 63, 431-2(1950) Sept. 23.

Methods of recovery of germanium from the flue dust of gas works or other coal consumers are briefly discussed, and some properties and uses of the element are mentioned.

125

American Smelting and Refining Co.
LIQUID METAL HEAT TRANSFER FLUID. VOLUMETRIC CHANGES IN ALLOYS FREEZING BELOW 98°C. J. L. Everhart and E. L. Van Nuis. June 19, 1950. 23p. (NP-1636)

The changes in volume of a series of low-melting alloys on freezing and cooling to 20°C have been determined by means of a volumetric dilatometer. The materials investigated were the eleven eutectic alloys, freezing below 98°C, in the systems containing bismuth, indium, lead, tin, and thallium. All of the alloys contracted on freezing. Two expanded after solidification while the others showed no such effect. 15 references. (auth)

126

National Physical Laboratory (Great Britain)
SOME PROPERTIES OF URANIUM. C. Sykes. Apr. 19, 1945. 6p. (Br-203A)

Two specimens of U in the form of disks about 3 cm in diameter and 1 cm thick were obtained. The microstructure of the material was examined, thermal curves were taken, the hardness was measured, and some experiments were carried out to determine whether the material was forgeable at room or elevated temperatures.

127

THE THERMODYNAMICS OF LIQUID METALLIC SOLUTIONS. John Chipman and John F. Elliott. Trans. Am. Soc. Mech. Engrs. 42a, 102-43(1950). (See also NSA 4-4892).

This paper reviews the principal experimental methods which have been used in determining the thermodynamic functions, free energy, enthalpy, and entropy, in liquid metallic solutions. Computational methods for these and the derived quantities, the thermodynamic potential, activity and activity coefficient, are illustrated. A bibliography is included. 139 references. (auth)

128

TITANIUM METAL. POTENTIALITIES AS A CONSTRUCTIONAL MATERIAL. Felix B. Litton. Chem. Trade J. 127, 667-8(1950) Sept. 22.

Methods of production, powder metallurgy procedures, physical and mechanical properties, corrosion resistance, and alloys of titanium are briefly discussed.

129

THE URANIUM IRON SYSTEM. J. D. Grogan. J. Inst. Metals 77, 571-80(1950) Aug.

The solubility of iron in solid uranium increases with temperature from about 0.004 wt. % (0.018 at. %) at 600°C to about 0.35 wt. % (1.5 at. %) at 805°C, the temperature at which the solid-solubility curve meets both the solidus and a peritectic horizontal line where liquid reacts with solid uranium to form the compound U_6Fe. No discontinuous change in solubility has been detected at the transformation of α- into β-uranium but at the transformation of β into γ the solubility increases from 0.1 to 0.2 wt. % (0.4 to 0.8 at. %). The liquidus meets the peritectic horizontal at about 5 wt. % (18 at. %) iron. The compound U_6Fe forms with another compound (UFe_2) a eutectic which contains about 11 wt. % (34 at. %) iron and melts at 725°C. The compound UFe_2 melts at 1230°C and forms, with iron, a eutectic which contains about 47 wt. % (78 at. %) iron and melts at 1055°C. X-ray examination has confirmed the existence of these two compounds. The structure of UFe_2 is discussed. (auth)

MINERALS AND MINERALOGY

130

ACTIVITY OF SMALL CRYSTALS WITH PLEOCHROIC HALOS CONTAINED IN A GRANITE. Rene Coppens. Compt. rend. 231, 343-5(1950) July 31. (In French)

Continuing a series of observations on the radioactivity of igneous rocks (latest reference: Compt. rend. 229, 1221(1949)), photoemulsion tracks were obtained with pulverized samples, polished specimens, and polished slides of a granite. Besides radioactive inclusions accounting for ⅔ of the activity and corresponding to a content ratio $C_{Th}/C_U = 1.8$, small crystals with pleochroic halos, scattered in the biotite, emit about 0.5 α rays/cm^2 sec; this activity about equals that of large crystals with a low Th content observed by the author in other rocks (Compt. rend. 228, 1218(1949)).

131

Department of Mines and Technical Surveys
ANALYSIS OF URANIUM IN ORES BY GEIGER METHODS. Mar. 10, 1950. 13p. (NP-1601)

Determinations of uranium in ores may be made by measurement of the radioactivity of these ores. The most commonly used method is that of measuring β radiations with the tray-type β counter. This will give an accurate uranium determination provided the sample does not contain Th and that the β and γ activities have not been disturbed from their natural state of equilibrium. Such a loss of equilibrium will result from milling the ore or from the weathering of the surface rock. A method is described which corrects for errors due to loss of equilibrium. The β and γ activities are measured simultaneously in one simple operation. This method is recommended for assaying samples resulting from milling operations and is limited only by the presence of Th in a ratio greater than 1 part of Th to 20 parts of U. A third method is recommended for the analysis of exploration samples and diamond drill cores, which may be assayed in the uncrushed state. Rapid determinations of a large number of samples is possible with a pressure ionization chamber which is sensitive to γ activity. (See also Can. Mining Met. Bull. 43, 461-4(1950) Aug.) (auth)

132

CONCENTRATION AND EXTRACTION OF URANIUM FROM SEVERAL TYPES OF CANADIAN ORES. Can. Mining Met. Bull. 43, 454-60(1950) Aug.

This paper describes treatment possibilities for some of the ores that have been treated at the Mines Branch, and shows how the character of these ores influences methods and results. Descriptions of uranium ores, methods for treatment, examples of ores treated, leaching processes, etc., are included.

133

FRACTURE SYSTEMS IN THE PITCHBLENDE DEPOSITS OF THE BEAVERLODGE LAKE AREA, SASKATCHEWAN. R. B. Allen. Can. Mining Met. Bull. 43, 436-7(1950) Aug.

This paper is prepared to make available information of possible value in exploration for and the early development of, radioactive mineral occurrences in the area about Lake Athabaska. Discussion is limited to radioactive occurrences in well-defined veins or fractures, and is not intended to apply to zones of disseminated radioactivity. The basis of the paper is a close study of radioactive fractures and veins at Martin Lake, Saskatchewan, and at the Nisto property of Transcontinental Resources, Limited. It is thought that enough evidence has been gathered to suggest that most radioactive veining in the Athabaska area will be found related to shears, an older and radioactive set striking generally slightly north of east and a younger set striking approximately northeast. Faults with these strikes are in evidence throughout the area, an example of the radioactive set being the St. Louis fault of the Beaverlodge area, while the large Crackingstone fault of the western Athabaska region may serve as a representative of the younger set.

134

MARYSVALE URANIUM REVIEW. Mining World 12, No. 8, 10-13(1950) July.

A historical account of the prospecting and location of the uranium mining area is presented. AEC activities in connection with the mining activities are also reported.

135

POSSIBILITIES AND LIMITATIONS OF GRAVITY CONCENTRATION AS APPLIED TO PITCHBLENDE ORES AT PORT RADIUM, N.W.T. E. B. Spice. Can. Mining Met. Bull. 43, 446-9(1950) Aug.

In general, it may be said that when pitchblende occurs free, to a large extent, from sulfides or arsenides of high specific gravity, and when the bulk of the pitchblende is localized rather than disseminated, excellent recoveries, high ratios of concentration, and good grades of concentrates, will result from proper gravity concentration. On the other hand, if the ore contains pitchblende intimately or otherwise mixed with large quantities of arsenides or sulfides, or if the pitchblende is finely disseminated, gravity concentration alone will yield high recoveries only at the expense of very low-grade concentrates and low ratios of concentration. Because of the rarity of occurrences of economic deposits of pitchblende, it is not likely that the milling of pitchblende ores will ever be an important part of the ore dressing field.

136

THE RADIOGENIC CONCENTRATION OF URANIUM ORES. L. A. Kaufman. Can. Mining Met. Bull. 43, 450-3(1950) Aug.

The Bureau of Mines, Ottawa, in conjunction with Eldorado Mining and Refining (1944), Limited, has developed an automatic concentrator for uranium ores. A brief review of radioactivity is given which shows the present limitations for obtaining good results by electronic concentration. The ores after being mined, or at any other stage of a concentrating process, can be analyzed for the uranium dissemination and from these results the possibility of an economical concentration can be estimated. The electronic and mechanical parts of the equipment are described. Difficulties in the operations, and means by which they have been overcome, are discussed. The capacity of the units, the results obtained, the man power required, and other pertinent data are presented. Simple control analysis on the per cent U_3O_8 has been developed. Research is continuing along lines to develop a more completely automatic unit using a scintillation detector, and applying a few new ideas and some devices that have been developed in color sorting. (auth)

137

SOME NOTES ON URANIUM IN BRITISH COLUMBIA. John S. Stevenson. Can. Mining Met. Bull. 43, 434-5(1950) Aug.

Where uranium-bearing veins have been found in British Columbia, the uranium mineral is the crystalline variety of uranium oxide, uraninite, rather than the massive non-crystalline variety, pitchblende, which is found in the Great Bear Lake deposit and in other similar deposits along the southwestern margin of the Precambrian shield. The principal occurrences of uranium known so far in British Columbia are associated with bodies of granodiorite and quartz diorite along the eastern side of the Coast Range belt of batholiths. At some places the uranium mineral identified as uraninite occurs in deposits that also contain abundant cobalt-nickel sulfarsenides and molybdenite. At these sites the uraninite occurs as clusters of small

black crystals of submetallic luster that may be seen upon careful searching of a highly radioactive specimen with a hand lens.

138

SUMMARY ACCOUNT OF CANADIAN URANIUM DEPOSITS. A. H. Lang. Can. Mining Met. Bull. 43, 426-33(1950) Aug. (See also NSA 3-1909)

The paper contains short accounts of the mineralogy of uranium and of the types and distribution of occurrences, brief regional descriptions including information on some of the characteristic deposits, and conclusions regarding prospecting and development possibilities.

139

URANIUM EXPLORATION IN THE UNITED STATES. Phillip L. Merritt. Can. Mining Met. Bull. 43, 438-42 (1950) Aug.

The U. S. Atomic Energy Commission program of exploration for uranium ores is outlined. Results are summarized by the following: (1) It has located many additional deposits of carnotite on the Colorado Plateau as a result of intensive exploration and mining activity. (2) It has established the fact that primary uranium vein deposits do exist in the United States. These have been found in the Colorado, Front Range, in the Coeur d'Alene mining district in Idaho, and in the Upper Peninsula of Michigan. (3) It has led to the discovery of numerous occurrences of both primary and secondary uranium minerals in western areas of the Colorado Plateau, such as those at Marysvale, Utah. (4) It has developed extensive information concerning low-grade uranium deposits in shales and phosphates. The information indicates that under certain conditions it might become feasible to mine and recover uranium from these very low-grade ores.

140

URANIUM, THORIUM AND RARE-EARTH ELEMENTS. Charles W. Chesterman. Division of Mines, Department of Natural Resources, Mineral Commodities of California, Bull. 156, 361-3(1950) Aug.

The presence of minerals containing uranium, thorium, and the rare-earth elements in California is discussed. Geological occurrences of the three minerals, pitchblende (uraninite), carnotite, and monazite are indicated. Utilization of uranium and thorium based on energy and nonenergy use is outlined. Sources of uranium in the Belgian Congo and Canada are mentioned. Thorium and rare-earth metals formerly from monazite mined in Brazil and India are said to have been cut off.

PHYSICS

141

ANNUAL REPORT ON NUCLEAR RESEARCH. University of Pennsylvania. June 30, 1950. 20 p. (NP-1671) 1950. 20p. (NP-1671)

Statitron. The status of reconstruction of the statitron electrostatic generator is given, and some operating techniques are described. The RaD (Pb^{210}) experiments have been concluded. No β rays were seen even after a 33-day exposure in the β-ray spectrograph. The 19-kev γ-ray line was not confirmed, and the continuum seems to be instrumental.

Betatron. Changes made in the 22-Mev betatron during the year are described. (γ,n) reactions which result in stable nuclei are being investigated, the photoneutrons being detected with an enriched $B^{10}F_3$ counter. Preliminary results on some thresholds are given. An extensive investigation of the distribution in time of radiation from the betatron has been initiated. A nuclear camera has been constructed and used to observe the photoprotons from (γ,n) processes in nuclear emulsions. The angular distribution and energy distribution of the photoprotons from Mg^{25} are reported. O^{18}-enriched water was irradiated with 17- to 25-Mev x rays, and the resulting delayed-neutron yield curve of N^{17} is presented. The scintillation method of detecting photoprotons is being investigated.

Theoretical Research. A formulation of the nuclear three-body problem has been developed which promises to be very convenient for the calculation of binding energies and scattering cross sections. The possibility of replacing the resulting integral equation by a set of simultaneous equations is being investigated. A thorough study has been made of all possible corrections to the present calculated value of the displacement between the 2S and 2P levels of hydrogen (Lamb shift). A rather direct test of the α-particle picture of nuclear structure should be afforded by a study of reactions in which γ rays eject α particles from nuclei such as C^{12}, O^{16}, and Ne^{20}.

142

PHYSICS AT LIVERPOOL. R. Huby. Nature 166, 552-5 (1950) Sept. 30.

Papers presented at the meeting of the Physical Society at Liverpool, England, July 7-8, 1950, on the theory of solids and experimental and theoretical nuclear physics are briefly summarized. A brief description of the new Nuclear Physics Laboratory, designed to accommodate a 400-Mev synchrocyclotron and a Cockcroft-Walton accelerator, is presented.

COSMIC RADIATION

143

ANISOTROPY OF COSMIC RAYS IN HIGH ALTITUDES AS STUDIED WITH PHOTOGRAPHIC EMULSIONS. Pierre Demers, Réal Courtemanche, and Gilles Lamarche. Compt. rend. 231, 651-3(1950) Oct. 2. (In French)

Using packs of supportless emulsion films, self-oriented with the aid of a compass, balloon experiments were made at 14 to 26 km altitude, in 57°N geomagnetic latitude

(Montreal, Canada). Sixty-nine stars and 6 primary tracks were observed in a preliminary survey. The predominant westerly direction of the primaries, and the NW and SE maxima in the direction of the star prongs confirm the extraterrestrial origin and the positive charge of the primary cosmic rays.

144

COSMIC RAY MEASUREMENTS BETWEEN AUSTRALIA AND JAPAN. P. G. Law, C. D. McKenzie, and H. D. Rathgeber. Australian J. Sci. Research 2, 493-505(1949) Dec.

Cosmic-ray results obtained on a journey to and fro between Australia and Japan are described. The apparatus was that used previously on the H.M.A.S. Wyatt Earp (D. E. Caro et al., Australian J. Sci. Research 1A, 261(1948)), but it has since been modified and extended to record showers. A latitude effect of 20% was found for rays of vertical incidence. The difference between electron and meson components did not exceed the statistical errors of 2%. For wide-angle coincidence telescope measurements the latitude effect reduces to 13%. Further it has been found that a latitude effect of some 10% exists for extensive showers of an average spread of 1 m. An observed latitude effect of penetrating extensive showers falls, however, within the standard deviation of the measurements. The stated findings were not corrected for barometric and temperature effects nor for variations in height of the meson-producing layer. Evidence is presented of the existence of a semi-diurnal variation at the equator and at Kure of opposite phase to the barometric pressure variations and of about twice the coefficient of the normal barometric effect. The maximum of the diurnal period occurs at Kure at 2 hr local time and at the equator at 19 hr. A temporary increase of between 2 and 3% in cosmic-ray intensity during the period July 29-31, 1948, is noted. (auth)

145

COSMIC RAYS AND MESONS. Pierre Rousseau. Nature, La 257-62(1950) Sept. (In French)

An elementary outline of cosmic radiation phenomena is presented.

146

ENERGY AND DENSITY DISTRIBUTION OF COSMIC-RAY NEUTRONS. William O. Davis. Phys. Rev. 80, 150-4(1950) Oct. 15.

The theory of atmospheric neutron measurements is reviewed in the light of recent data on neutron scattering and capture cross sections in air and boron. It is concluded that the mean energy of atmospheric neutrons is 0.26 ev rather than the previous value of 0.06 calculated by Bethe, Korff, and Placzek (Phys. Rev. 57, 573(1940)). The spatial distribution is then recalculated and found to agree closely with earlier calculations by Flügge (Cosmic Radiation, Chap. 14, Dover Publications, N. Y., 1946). Recent measurements of neutron intensity as a function of altitude are discussed in the light of the foregoing and are found to offer confirmation of the new calculations. (auth)

147

ENERGY SPECTRUM OF A SIMPLE COSMIC INDUCTION ACCELERATOR. G. Dishkant. Zhur. Ekspti. i Teoret. Fiz. 20, 206(1950) March. (In Russian)

On the basis of Alfven's hypothesis of the origin of cosmic rays (Arkiv Mat. Astron. Fysik 28A, 1(1942)), the energy spectrum of particles accelerated by the electromagnetic field of a rotating star was calculated for the simple case when the direction of the magnetic moment coincides with the rotation axis. Stars possess considerable electric charges. The great majority of accelerated particles, both positive and negative, are returned to the star's surface, their energies being mostly 10^{-3} to 10^{-4} times the maximal value. Only sufficiently fast particles of one sign (that of the star's charge) leave the star. The calculated spectrum differs from that of the primary cosmic radiation; this may be due to the lack of accurate data on the magnetism and composition of stars.

148

THE MOMENTUM AND SIGN OF FAST COSMIC RAY PARTICLES. J. E. Moyal. Phil. Mag. 41, 1058-77(1950) Oct.

In order to study the statistical estimation of momentum and sign of fast cosmic ray particles from their magnetically deflected and multiply scattered tracks in the photographic emulsion, the probability distribution of the observed angular deviations along the track is derived, taking into account errors of observations. With the help of this distribution, approximate expressions are obtained for maximum likelihood estimates of the magnetic deviation and the mean-square scattering deviation. The standard errors of these estimates are found, and their efficiency is discussed. After showing how the observations of magnetic and scattering deviations in a large number of tracks can be combined to verify theoretical mean-square scattering formulas, the estimation of the momentum p of particles from these deviations is discussed. An expression is derived for the value of the optimum cell length, at which the error of the scattering determination of p is minimized. The relative errors of the magnetic and scattering determinations of p are compared at this optimum cell length; it is found that there is a critical value of p, depending on the field, below which the scattering determination is more accurate. An expression is given for the probability that, given the signed total deviation of a track in the magnetic field, the particle should be positively or negatively charged. A method is given of estimating the ratio of positively to negatively charged particles in terms of the observed signed deviations in a number of tracks. (auth)

149

THE NATURE OF THE COSMIC RADIATION. D. V. Skobel'tsyn. Vestnik Akad. Nauk S.S.S.R. 20, 31-45(1950) Apr. (In Russian)

In this address delivered before the Russian Academy of Sciences a general account is given of the achievements of Russian workers (under the direction of Vernov and Dobrotin) in the field of cosmic radiation. The part they played in the establishment of the protonic nature of the

primary rays is outlined, and especially emphasized is their discovery of the so-called "electron-nuclear" showers, powerful explosions produced by the primaries and then repeated by succeeding generations (cascades) of very energetic "nucleo-active" particles in their collisions with nuclei of the atmosphere; this process of dissipation of primary energy by large portions is regarded as the principal mechanism among those active in cosmic radiations, accounting for the presence of large quantities of electrons in upper layers of the atmosphere, for Auger showers, and for other phenomena.

150

THE NATURE OF PENETRATING PARTICLES IN ELECTRON-NUCLEAR SHOWERS. N. Birger, G. Zhdanov, V. Polynov, and S. Slavatinskiĭ. Zhur. Eksptl. i Teoret. Fiz. 20, 478-9(1950) May. (Letter to editor; in Russian)

While it is established (Birger et al., Zhur. Eksptl. i Teoret. Fiz. 19, 826(1949)) that the soft component of the "electron-nuclear" showers consists of electrons and photons, very little is known about the hard rays (Rochester et al., Proc. Phys. Soc. 61, 307, 535(1948)). Using a cloud chamber in a magnetic field and a hodoscope, the authors were able to observe (in a total of 18 cases) the predominance of protons among penetrating particles of small energy ($pc \leq 1.3 \times 10^9$ ev), and the presence of a certain number of lighter particles of both signs.

151

A SURVEY OF RECENT WORKS ON PENETRATING SHOWERS AND PENETRATING PARTICLES. Kurt Sitte. Acta Phys. Aust. 4, 18-61(1950) July. (In German)

Continuing a detailed discussion of principal investigations on penetrating components of the cosmic radiation (Acta Phys. Aust. 3, 198(1949); NSA, abstract 4-2006), with a special emphasis on the problem of the existence of various mesons and other particles, the author surveys the following works, published since 1947: experiments of Broadbent and Jánossy on local and extensive showers; investigations of Auger and his group, and of Alikhanov and coworkers; and Wilson-chamber measurements by Mitra, and by Rochester and Butler.

CRYSTALLOGRAPHY AND CRYSTAL STRUCTURE

152

Carnegie Institute of Technology
PROGRESS REPORT FOR JANUARY, FEBRUARY, MARCH 1950. R. Smoluchowski, M. Achter, L. Couling, R. Flanagan, D. Shafer, and R. W. Turner. April 10, 1950. 3p. (NYO-516)

The measurements of the rate of intergranular penetration of Ag in Cu as a function of the relative orientation of the columnar copper grains were continued. The data show, in accordance with theory, that at small and large angles of misfit, the penetration is small; however, at intermediate angles, 35 to 65 deg, the penetration is larger. The object of recent experimental work has been to obtain single crystals of copper (3/16 in. diameter and approximately 2 in. long) with a vertical (100) axis. A crystal so obtained was then used as a seed to obtain a crystal approximately 6½ in. long, which on being cut produced 3 seed crystals. A radioactive tracer technique is being employed to determine grain boundary diffusion rates of silver in the tri-crystals of copper mentioned. Preliminary tests on a small angle x-ray scattering camera revealed that the camera is capable of considerably more resolution than had been anticipated. The camera is being modified to permit use of a slit with very fine adjustments located between the crystals, and the crystal mounts are being modified to permit closer adjustment, better clamping, and less probability of temperature gradients which would affect the setting. A sample has been obtained which may be used as a standard to calibrate the absorption corrections necessary in pole figure studies.

153

ALLOTROPY OF BERYLLIUM. S. S. Sidhu and C. O. Henry. J. Applied Phys. 21, 1036-7(1950) Oct.

The allotropy of beryllium has been confirmed by employing different alloying properties of allotropic forms of metallic elements. Alloys of beryllium and gold, studied by x-ray diffraction methods, showed that the limit of solubility of gold in beryllium is between 2 and 3 at. %, and practically all of it is dissolved in the β form. The lattice parameters of the two forms observed here are $a_0 = 2.286$ A, $C_0 = 3.588$ A, and $C_0/a_0 = 1.570$ for the α form, and $a_0 = 6.93$ A, $C_0 = 11.35$ A, and $C_0/a_0 = 1.638$ for the β form. The volume of the unit cell of the β form is about 29 times that of the α form. (auth)

154

ANOMALOUS SOLID SOLUTIONS OF CERIUM SESQUIOXIDE IN CERIUM DIOXIDE. Maria Bruno. Ricerca sci. 20, 645-7(1950) May. (In Italian)

By using dioxides and sesquioxides of rare earths, the author studies "disorders" in crystalline lattices of "anomalous" solid solutions, in particular changes brought about in the distribution of cations and anions in a lattice of the fluorite type of a compound MeX_2, into which a compound $Me_2'X_3$ has been incorporated (Gazz. chim. ital. 76, 246(1946); 78, 83 and 95(1948); Ricerca sci. 18, 578(1948)). In the present case, experiments with the pair CeO_2/Ce_2O_3 (case of identical cations) confirmed previous generalizations by showing that, in mixed crystals containing up to 20 mole % of Ce_2O_3, the fluorite-type lattice is retained, the dimensions of the unit cell growing with the Ce_2O_3 content; furthermore, while the cations (both Ce^{++} and Ce^{+++}) are statistically distributed over the cationic positions of the lattice, the anions O^{--} occupy, statistically, some of the available anionic positions, leaving the others unoccupied (this is the only possible form of reticular disorder in the present case).

155

ATOMIC POSITIONS AND VIBRATIONS IN THE FERROELECTRIC $BaTiO_3$ LATTICE. W. Kaenzig. Phys. Rev. 80, 94-5(1950) Oct. 1. (Letter to the editor)

The integrated reflections (00h) and (0h0) from untwinned $BaTiO_3$ single crystals were measured up to high orders (h = 10) as a function of temperature in the range from 15 to 310°C using Mo K_α radiation and a precision ionization spectrometer. The influence of extinction could be estimated and taken into account, enabling one to determine the vari-

ation of the structure factor with temperature from the observed variation of the integrated reflection. The Ti ions and the O ions lying on the same line along the z axis undergo a sudden displacement along this axis in opposite directions at the transition point (120°C), this jump being followed by a continuous change as the temperature decreases. A sudden variation of the root-mean-square amplitude of the vibration of the Ti ion along the z axis is shown at the transition point and is followed by a continuous rapid decrease below.

156

THE DISTRIBUTION OF THORIUM ISOTOPES BETWEEN LANTHANUM FLUORIDE CRYSTALS AND THEIR SATURATED SOLUTION IN 3 AND 12% HNO_3 AT A TEMPERATURE OF 100 DEGREES. V. G. Khlopin and M. S. Merkulova. Doklady Akad. Nauk S.S.S.R. 65, No. 6, 1949 (Translation, AEC File No. NP-2156)

This article was abstracted in Nuclear Science Abstracts as abstract 3-2144.

157

THE FORCES EXERTED ON DISLOCATIONS AND THE STRESS FIELDS PRODUCED BY THEM. M. Peach and J. S. Koehler. Phys. Rev. 80, 436-9(1950) Nov. 1.

An analogy is drawn between the behavior of a closed line dislocation in a stress field and the behavior of a closed current-carrying loop in a field of magnetic induction. Then formulas for the stress components caused at any point of an infinite elastically isotropic crystal by a line element of a general Burger's dislocation are deduced from Burger's expressions for the displacements (Proc. Koninkl. Nederland. Akad. Wetenschap. 42, 293(1939)). These formulas bear a close analogy to the Biot-Savart formula of electromagnetic theory. Both of these results taken together constitute a complete system for the investigation of the mutual interaction of dislocations in an infinite elastically isotropic crystal.

158

INFLUENCE OF PLASTIC FLOW ON THE ELECTRICAL AND PHOTOGRAPHIC PROPERTIES OF THE ALKALI HALIDE CRYSTALS. Frederick Seitz. Phys. Rev. 80, 239-43(1950) Oct. 15.

The influence of plastic flow on the ionic conductivity and darkenability of the alkali halides is discussed on the basis of the assumption that vacant lattice sites are generated during lattice flow and condense to form clusters during a subsequent period of time. These assumptions appear to lead to a reasonable interpretation of the available experiments on the changes in properties of the alkali halides which accompany plastic flow. The bleaching action of plastic flow on colored crystals is also discussed, although the mechanism appears to be much less apparent in this case. (auth)

159

MOTION PICTURE STUDIES OF ELECTRON BOMBARDMENT OF COLLOIDAL CRYSTALS. John H. L. Watson and Luther E. Preuss. J. Applied Phys. 21, 904-07(1950) Sept.

Phenomena not seen or recorded by orthodox methods are observed on the large number of micrographs which were taken during a motion picture experiment, and reaction times as short as 0.03 sec can be calculated. The technique is useful for investigating solid-liquid-solid changes both by direct observation and by recording Bragg reflections. In most cases a preliminary effect of electrons upon crystals is to drive off water. In the case of sodium chloride crystals a residual envelope is left. Inside this envelope, small particles, both solid and liquid, are observed to move rapidly due, it is believed, to a combination of Brownian movement and convection. These gradually evaporate and diffuse through the wall. The possibility is discussed that the residual envelope is formed by contamination. Examples are also taken from bombarded, colloidal crystals of tungsten oxide. (auth)

160

RELATIONS AMONG THE CRYSTAL STRUCTURE FACTORS. H. Hauptman and J. Karle. Phys. Rev. 80, 244-8(1950) Oct. 15.

New relations among the structure factors and their magnitudes have been derived which take the form of inequalities. In the limiting case of point atoms, some of these reduce to equalities and many additional relations are also valid. The crystal structure problem for point atoms is discussed from the point of view of equivalent sets of algebraic equations. In this development no special symmetry relations are required. Because of the complexity of the results of this paper, their general application remains a problem to be solved.

161

SELF-DIFFUSION IN TIN CRYSTALS. P. J. Fensham. Australian J. Sci. Research 3, No. 1, 91-104(1950) Mar.

The rate of self-diffusion in single crystals of white tin of various orientations has been measured using the radioactive isotope Sn^{113}. The ratio of the diffusion coefficients parallel and perpendicular to the tetragonal (c) axis is approximately 2 at 180°C and approximately 3 at 223°C. The diffusion coefficients in both directions at various temperatures are given by the Arrhenius expressions $D_c = 1.2 \times 10^{-3} e^{-10,800/RT}$ cm²/sec and $D_a = 3.7 \times 10^{-3} e^{-9,900/RT}$ cm²/sec. The anisotropy is discussed in terms of the vacancy mechanism of diffusion. (auth)

162

Brown University
SINGLE CRYSTAL PLASTICITY; PART I. SOME ESSENTIAL BACKGROUND TO THE UNDERSTANDING OF THE MECHANICAL BEHAVIOR OF BULK MATERIALS. Louis Gold. Sept. 1, 1948. 177p. (NP-1639)

An extensive general discussion of the fundamentals of crystallography and x-ray diffraction, techniques for preparing large crystals, the nature of imperfection in solids, and methods of x-ray imperfection analysis is presented.

163

Auburn Research Foundation
THE STROBOSCOPIC X-RAY DIFFRACTION EXAMINATION OF OSCILLATING PIEZO-ELECTRIC CRYSTALS (SECOND ANNUAL REPORT). R. Pepinsky. April 15, 1948. 104p. (NP-1632)

A review of the progress during the second year of investigation is presented which covers the following: x-ray scattering from ammonium dihydrogen phosphate; mounting and orienting the oscillating crystal for x-ray observations; x-ray intensity measurements; film photometers and Geiger counter studies; further details on high-voltage stabilizer and x-ray tube operation. Circuit drawing and graphs are included.

164

Rutgers University
TECHNICAL REPORT NO. 1 ... MAY 1949 - JUNE 1950. Alfred J. Reis and Sigmund Weissmann. June 15, 1950. 49p. (NP-1630)

A new x-ray-diffraction method has been developed for the study of imperfections of crystal structure in polycrystalline specimens of microscopic crystallite size. The technique and theory of this multiple-exposure method using a double x-ray spectrometer are illustrated by experiments on commercial silicon powder. A modified double x-ray spectrometer for testing the parallelizing performance of monocrystals is also described.

165

VARIATION OF AMPLITUDE-DEPENDENT INTERNAL FRICTION IN SINGLE CRYSTALS OF COPPER WITH FREQUENCY AND TEMPERATURE. Arthur S. Nowick. Phys. Rev. 80, 249-57(1950) Oct. 15.

The amplitude-dependent internal friction which originates in the motion of dislocations in single crystals of copper is studied as a function of frequency and temperature. Quantities are introduced which express the dependence of internal friction and of Young's modulus on strain amplitude, and it is shown that these quantities are significant measures of the properties of a crystal. Measurements made between −60 and + 33°C show that the observed internal friction can be expressed as the product of a function of temperature and a function of amplitude alone. The data also indicate that the internal friction and elastic modulus are frequency independent when the structure sensitivity of the material is taken into account. The results are considered in terms of two viewpoints: a mechanism of relaxation by which dissipation is controlled through a rate process, and simple hysteresis, by which the stress-strain loop is independent of the rate of traversal. It is shown that the latter mechanism gives much better agreement with the experimental facts. Finally, simple hysteresis is interpreted in terms of the dislocation theory. (auth)

ELECTRICAL DISCHARGE

166

ELECTRON REMOVAL IN HELIUM AFTERGLOWS. R. A. Johnson, B. T. McClure, and R. B. Holt. Phys. Rev. 80, 376-9(1950) Nov. 1.

Observations of the electron density, visible and near ultraviolet light intensity, and spectrum associated with a 3000 mc pulsed electrodeless discharge have been made. The electron density data indicate recombination-type electron removal with a constant $\alpha = 1.0 \times 10^{-8}$ cm^3/ion sec in reasonably good agreement with previous data. During the discharge, the spectrum of atomic helium predominates. In the afterglow, the band spectrum of He_2 predominates. The total energy radiated in the wavelength range 2000 to 8000 A is estimated as 0.5 ev per electron removed. A maximum in the light intensity occurs a few hundred microseconds into the afterglow. The following mechanism is quantitatively consistent with all of the data: He^+ forms He_2^+ by undergoing a triple collision with two neutral atoms, after which the molecular He ions combine with electrons. (auth)

167

EXPERIMENTS ON THE INITIATION OF ELECTRIC ARCS. F. E. Haworth. Phys. Rev. 80, 223-6(1950) Oct. 15.

Arcs have been struck in vacuum between widely spaced electrodes by positive ion charging of an insulating film on the cathode, at separations from 0.5 to 5 mm and at potentials from 34 to 2000 volts. The arc current must be allowed to grow initially at the rate of at least 10^6 amp/sec for the arc to occur. These experiments constitute a test of one of the fundamental steps postulated to account for the initiation of an arc between electrodes coming together at low voltages.

168

A NEW FORM OF DISCHARGE IN GAS MIXTURES: THE FLASHING DISCHARGE. Carl Kenty. Phys. Rev. 80, 96 (1950) Oct. 1. (Letter to the editor)

When impurities (~4 μ N_2 or 0.13 μ CO) are added to the discharge column described in the preceding letter (abstracted here as NSA 5-170), the discharge suddenly breaks into a "flashing" form. A sequence of events is proposed to account for the flashes by excitation of A and Hg metastable atoms. The effect is less striking in Kr and absent in Xe.

169

ROLE OF METASTABLE ($^3P_2$) Hg ATOMS IN LOW CURRENT DISCHARGES IN Hg RARE GAS MIXTURES. Carl Kenty. Phys. Rev. 80, 95-6(1950) Oct. 1. (Letter to the editor)

A positive column d-c hot cathode discharge of about 1 ma in a few millimeters of a rare gas (e.g., A, Kr, Xe) plus a few microns of Hg in a 3½-cm tube has been found to have a positive characteristic and ordinary running striations. Strong illumination with Hg radiation (transmissible through glass) nearly doubles the voltage drop, doubles the 2537 output (B_u), nearly doubles the electron temperature (T_e) as shown by probe measurements, and nearly suppresses the striations. These and other results are explained as arising from the destruction of Hg metastables by irradiation, the ionization evidently being mainly two-stage. In pure gas $^3P_2$ furnishes most of the ions, but with impurities $^3P_0$ takes over this role.

ELECTRONS

170

ELECTRON TRANSFER IN INTERMETALLIC COMPOUNDS. Linus Pauling. Proc. Natl. Acad. Sci. U. S. 36, 533-8(1950) Oct.

The elements are classified with respect to the effect of change of electron number on metallic valence, and the interatomic distances in some representative compounds, such as AlP, Al_2Au, and $PtSn_4$, are analyzed. It is concluded that electron transfer takes place in a great many interatomic compounds, and that the numbers of electrons involved are reasonable, in relation to the changes in valence resulting from loss or gain of electrons and to the partial ionic character of the bonds between unlike atoms and the striving of atoms toward electroneutrality.

171

M. I. T. Research Laboratory of Electronics
MEASUREMENT OF ELECTRON-ION RECOMBINATION. Manfred A. Biondi and Sanborn C. Brown. Aug. 3, 1949. 7p. (NP-1564; Technical Report No. 135)

Microwave techniques are applied to the measurement of the recombination between electrons and positive ions. The measured recombination coefficients for monatomic gases range from 1.7×10^{-8} cc/ion-sec for He to 3×10^{-7} cc/ion-sec for A. The recombination coefficients for diatomic gases range from 2.5×10^{-8} cc/ion-sec for H to 2.8×10^{-7} cc/ion-sec for O. At electron temperatures of 300°K, the recombination is found to be independent of pressure for the monatomic gases; a pressure dependence is observed in diatomic gases.

172

M. I. T. Research Laboratory of Electronics
MICROWAVE DETERMINATIONS OF AVERAGE ELECTRON ENERGIES AND THE FIRST TOWNSEND COEFFICIENT IN HYDROGEN. Lawrence J. Varnerin, Jr. and Sanborn C. Brown. May 24, 1950. 15p. (NP-1721)

A microwave method of determining the average energy of electrons in a gas in the presence of a d-c field by measuring the ratio between the electron diffusion and mobility has been developed. By solving for a-c and d-c distribution functions it is found possible to compare quantitatively the effective a-c ionization coefficient and the first Townsend coefficient in hydrogen. It is then possible to calculate the first Townsend coefficient from a-c breakdown data in hydrogen. These values have been compared with previously determined values. Measurements of average energy have been made, and the values calculated from theory are compared with previous measurements of average energy. All measurements are in substantial agreement with each other and with the theoretically determined values. (auth)

173

Atomic Energy Research Establishment
RANGES OF ELECTRONS IN MATERIALS. August 1950. 5p. (AERE-Inf/Bib-68)

A bibliography is presented which has been compiled from Nuclear Science Abstracts, Chemical Abstracts, and Science Abstracts A. The last two journals were searched from 1928 to 1950. 45 entries.

174

THE PROBABLE ENERGY LOSS OF ELECTRONS IN MATTER. S. D. Warshaw and Joses J. L. Chen. Phys. Rev. 80, 97-8(1950) Oct. 1. (Letter to the editor)

The experimental relationship of the probable energy loss of electrons vs. thickness of Al or Sn absorbers shows good agreement with the theoretical expression of Landau (J. Phys. U.S.S.R. 8, 201(1944)). The curve for "average" loss as calculated from the Bethe-Bloch formula (W. Heitler, The Quantum Theory of Radiation. London, Oxford Univ. Press., 1944. 2nd ed., p. 219 ff.) is seen to be quite different.

GASES

175

THE ELECTRICAL CONDUCTIVITY OF AN IONIZED GAS. Robert S. Cohen. Phys. Rev. 80, 230-8(1950) Oct. 15.

The interaction term in the Boltzmann equation for an ionized gas is expressed as the sum of two terms: a term of the usual form for close encounters and a diffusion term for distant encounters. Since distant encounters, producing small deflections, are more important than close encounters, consideration of only the diffusion term gives a reasonably good approximation in most cases and approaches exactness as the temperature increases or the density decreases. It is shown that in evaluating the coefficients in this diffusion term, the integral must be cut off at the Debye shielding distance, not at the mean interionic distance. For high temperatures and low densities the computed electrical conductivity is about 60% of the value given by Cowling's second approximation (Proc. Roy. Soc. (London) 183A, 453 (1945)).

INSTRUMENTS

176

Harvard University
A FLEXIBLE HIGH-VOLTAGE SQUARE WAVE GENERATOR. Langdon C. Hedrick. [nd.] (NP-1483)

The design of a high-voltage square-wave generator suitable for modulating the absorption cell of a microwave spectrograph is presented. Peak to peak voltages up to 1800 have been produced at 100 kc, feeding into a 800 $\mu\mu$f capacitative load. The lower half of the cycle is kept automatically at ground potential and the adjustment of voltage from 0 to 1800 is controlled by a single variable.

177

IONIZATION MEASUREMENTS AT VERY HIGH INTENSITIES. I. PULSED RADIATION BEAMS. J. W. Boag. Brit. J. Radiology 23, 601-11(1950) Oct.

In pulsed radiation beams the high ion density produced by each pulse encourages recombination between ions of opposite signs. Formulas are derived for the proportion of ions escaping recombination in plane-parallel, cylindrical, and spherical ionization chambers under a variety of different conditions. The screening effect of space charge is shown to be small in the case of plane geometry. The effect of an exponential fall in collecting voltage, as in condenser chambers, is considered, and the appropriate collecting efficiency is derived. Some experimental measurements on a 4-Mev linear accelerator are described. (auth)

178

THE p-GERMANIUM TRANSISTOR. W. G. Pfann and J. H. Scaff. Proc. I.R.E. 38, 1151-4(1950) Oct.

The transistor effect in p-type germanium is discussed and some properties are given for p-germanium transistors made in the laboratory. These exhibit higher cutoff frequency and somewhat lower current multiplication than their n-germanium counterparts. Under certain conditions a negative resistance "snap" effect is observed which is apparently peculiar to p-type germanium. Both types of transistor are governed by the same physical principles but they differ in the signs of the emitted carriers and of the bias voltages. (auth)

179

THE PRODUCTION OF PULSED MAGNETIC FIELDS USING CONDENSER ENERGY STORAGE. K. S. W. Champion. Proc. Phys. Soc. (London) 63, 795-806(1950) Oct. 1.

An economical way of producing a pulsed magnetic field is to use condensers as the energy source and an air-cored magnet coil which, with the storage condensers, forms an oscillatory circuit. By means of a switch the coil is connected to the charged condensers and then disconnected precisely at the end of one cycle. In this way all the stored energy is used to produce the field, while most of it is recovered at the end of the pulse, the only appreciable losses being due to the resistance of the coil and switch. The design of coils for use in the way described is considered in detail.

180

A SIMPLE FORM OF VOLTAGE STABILIZER. N. K. Saha, B. S. Chandersekhara, and M. K. Sundaresen. Proc. Natl. Inst. Sci. India 16, 127-33(1950) Mar.-Apr.

A simple form of voltage stabilizer for the range 600 to 2000 v, suitable for use with G-M counters is described. The stabilization is effected with the help of gas ionization in an air-discharge tube of variable pressure connected in parallel to the transformer output. At a stabilized voltage of ~1500 v, a deviation of ~2.5% was observed when the transformer output was varied between 2000 and 3500 v. As such a wide variation in the transformer output is not likely to occur in practice, the stabilization attained is generally satisfactory. Simplicity of the electrical circuit, ease of operation in changing the range of stabilized voltage, good accuracy, and low cost are the main features of the method. (auth)

MASS SPECTROGRAPHY

181

INTRODUCTION OF LIQUID SAMPLES INTO THE MASS SPECTROMETER. K. M. Purdy and R. J. Harris. Anal. Chem. 22, 1337-8(1950) Oct. (Note on analytical procedures)

A disadvantage of routine methods of introducing samples of liquid into mass spectrometers has been the introduction of air with each sample. A constant-volume 0.001-ml capillary pipet has been developed to eliminate this difficulty. The pipet is completely immersed in a pool of mercury in a sintered-glass valve. Advantages of this procedure are that constant accurate volumes are introduced for calibrations and analyses without a measurement being required, and no sensitivity calculations are required, because computations are made directly from peak heights. These pipets have been used satisfactorily for analyzing liquids as high as C_{12} hydrocarbons with the inlet system at room temperature. A modified sampling method for viscous liquids is described.

182

ION SOURCES FOR MASS SPECTROMETERS STUDIED WITH THE AID OF A RHEOGRAPHIC MODEL; DETERMINATION OF TRAJECTORIES. Raymond Moch, Étienne Roth, and Jean Salmon. J. phys. radium 11, 524-8(1950) Aug.-Sept. (In French)

The optics of two Nier ion sources was studied by plotting equipotential curves with the aid of rheographic tank models, and calculating the trajectories of ions within the sources. This procedure permitted a comparison of apertures and of focusing properties of the sources. On the basis of the information obtained, a design of a third source is discussed. (auth)

MEASURING INSTRUMENTS AND TECHNIQUES

183

New York Operations Office
VARIATION OF FILM RESPONSE WITH TEMPERATURE. Hilda Bass. Aug. 3, 1950. 17p. (NYO-1522)

Three aspects of this relationship were investigated to determine the effect of heat on (a) the latent image following irradiation of the film but prior to development, (b) the film emulsion, and (c) direct radiolysis (decomposition of chemicals under the influence of radiation). In the first group, some films were exposed to beta radiation (0 to 1920 mrep) and other films to gamma radiation (0 to 3000 mr). After exposure, samples from these films were subjected to different heat treatments, some for periods of 4 and others for 8 hr at temperatures of 99 and 130°F. The heating produced no demonstrable effect on the beta or gamma latent image. In studying the effect of heat on the film emulsion, raw film which had been previously heated was then exposed either to beta or gamma radiation. No causal relationship could be established and it is concluded that there is no change in sensitivity of film emulsion which had been subject to this heat-treatment. The investigation of the effect of heat during exposure of film to beta radiation revealed that a false indication of dose, a value of 14% higher than at room temperature, is indicated on film exposure at 99°F. For film exposed at 130°F the dose indication is 23% higher than at room temperature. (auth)

184

University of California Radiation Laboratory
A NEW COUNTING RATE RECORDER. H. O. Anger. Aug. 30, 1950. 13p. (UCRL-885)

A counting rate recorder in which a series of points is plotted on a chart, the position of each point being directly proportional to the arithmetic mean of the counts received during fixed intervals of time, is described. It consists of

a G-M scaler, a Speedomax recorder, and an integrating circuit consisting of a mercury relay, condensers, and two switches operated by a cam which is added to the Speedomax recorder. (auth)

185

BACKGROUND TRACKS IN ELECTRON-SENSITIVE NUCLEAR EMULSIONS. J. H. Fremlin and Madeline C. Walters. Proc. Phys. Soc. (London) 63A, 1178-9(1950). (Letter to editor)

An investigation was made of the origin of background tracks in 200 μ thick photoemulsions Ilford G5 (250 electron tracks/mm^2/day at ground level). The plates, shielded and unshielded, were left in a mine 600 m below ground. Although at that depth the cosmic-ray intensity is negligible, the density of tracks was equal to that observed at ground level. Shielding with 2-in. lead showed that the main effect was due to the radioactivity of the surrounding rock (a Silurian sandstone), a result confirmed by measurements with counters; only a minor part of the background was attributable to contaminations in the emulsion and the glass of the plates.

186

A CALORIMETRIC MEASUREMENT OF THE DISINTEGRATION RATE OF A P^{32} SOURCE. J. G. Bayly. Can. J. Research 28A, 520-9(1950) Sept.

The calorimetric method of measuring radioactive sources is of value when the average energy per disintegration is known, and may be used to check the accuracy of an "absolute" β-counting technique. A differential calorimeter designed for this type of measurement and an experimental determination of the disintegration rate of a P^{32} source are described. The calorimetric measurement gave a value of the disintegration rate with a probable error of 0.7%, differing by 1.8% from the result obtained from an absolute count of the β activity. The absolute count was accurate to $\pm$2%. The calorimeter has a sensitivity limit of less than 10 μw, and makes use of thermistors to measure temperature changes of the order of 10^{-3}°C. (auth)

187

National Bureau of Standards
THE DEVELOPMENT OF A RADIATION QUALITY INDEPENDENT PHOTOGRAPHIC DOSIMETER; PRELIMINARY PROGRESS REPORT; COVERING THE PERIOD AUGUST 8, 1949, THROUGH JULY 1, 1950. Lauriston S. Taylor. 1950. 35p. (NP-1470)

The use of the film dosimeter with the history and aim of the present work, modification of x-ray spectra by absorbers, determination of absorber thickness, experimental verification of computations, and the proposed film dosimeter are discussed.

188

A DEVICE FOR DIFFERENTIAL COUNTING WITH THE AID OF PULSE AMPLITUDE SELECTORS. G. Valladas and J. Thenard. J. phys. radium 11, 501-6(1950) Aug.-Sept. (In French)

Various pulse amplitude selectors in use are described, and a new device is discussed in which the effect is independent of the duration and the shape of pulses received.

189

EFFECT OF TIME LAG IN THE MEASUREMENT OF DELAYED COINCIDENCES WITH G. M. COUNTERS. B. D. Nag, S. Sen, and S. Chatterji. Indian J. Phys. 24, 261-4 (1950) June.

A mathematical expression for the delayed coincidences between two G-M counters has been derived for both instantaneous and delayed radiations passing through the counters. In deriving the expressions, the time lag between the ionizing event and its recording by the G-M counters has been assumed to have a Gaussian distribution as a first approximation. The distribution function for the time lag has been found to differ from the Gaussian error function. Experimental curves can be checked against deduced inequalities. These checks have been used to check published curves for the delayed coincidence method of determining short-lived metastable states in isomeric nuclei. (auth)

190

ESTIMATION OF RADIOACTIVE HYDROGEN (TRITIUM). D. F. White, I. G. Campbell and P. R. Payne. Nature 166, 628-30(1950) Oct.

The counting characteristics of the gas produced by the action of tritiated water on aluminum carbide have been investigated. Deuterium oxide reacts at a slow rate with aluminum carbide below 65°C, and the reaction with THO was therefore done at 100°C. The methane was then partially purified by immersion in a dry-ice-acetone mixture. Activities were measured in the apparatus with a G-M counter. The apparatus is described and results are plotted.

191

FLIGHT RECORDERS. A TECHNIQUE FOR THE STUDY OF BIRD NAVIGATION. D. H. Wilkinson. J. Exptl. Biol. 27, 192-7(1950) Sept.

In investigations on the homing ability of birds, it is of importance to be able to determine the proportion of released time actually spent in flight rather than in resting or feeding. A simple, light-weight device which may be attached to the wing has been developed for this purpose. In flight, a photographic film is exposed to α rays from a polonium source. When the wings are folded, a steel ball under the influence of gravity acts as a diaphragm preventing exposure of the film. A weight as low as 20 mg should be attainable for this instrument, enabling the technique to be applied to quite small birds. Adaptations to distinguish between soaring and flapping, directions of flight, time spent on water or land, and air speeds are suggested.

192

GAMMA-RAY STUDIES USING DEUTERIUM-LOADED PHOTOGRAPHIC PLATES. C. H. Millar, A. G. W. Cameron, and M. Glicksman. Can. J. Research 28A, 475-87 (1950) Sept.

Deuterium-loaded nuclear emulsions have been used to study the γ rays of neutron capture in sodium, chlorine, and cadmium, and the γ rays following the β decay of N^{16}. Proton tracks caused by the photodisintegration of deuterium were measured, and from these the γ-ray energies were calculated. Several lines have been observed in the γ-ray spectra of neutron capture. The known energy of the

6.124-Mev γ ray following the decay of N^{16} (produced in the cooling water of the Chalk River pile) was used to calibrate the plates. A higher energy γ ray from the decay of N^{16} was tentatively identified as corresponding to a transition from the 6.897-Mev excited level of O^{16} to the ground state and was found to have one-seventh the intensity of the 6.124-Mev γ ray. (auth)

193

GRAIN COUNTS AND CORRECTED α-PARTICLE RANGE-ENERGY CURVE FOR ILFORD E-1 EMULSIONS. Isadore B. Berlman. Phys. Rev. 80, 96-7(1950) Oct. 1. (Letter to the editor)

Curves are shown giving the average number of grains in corresponding lengths of proton, deuteron, and α-particle tracks in Ilford E-1 nuclear emulsions.

194

A MAGNETIC ANALYZER FOR CHARGED-PARTICLES FROM NUCLEAR REACTIONS. C. W. Snyder, S. Rubin, W. A. Fowler, and C. C. Lauritsen. Rev. Sci. Instruments 21, 852-66(1950) Oct.

A double-focusing magnetic spectrometer for detecting and analyzing charged particles from nuclear reactions is described. The magnetic field, varying as $r^{-\frac{1}{2}}$ near an average radius of 10.5 in., extends over a semicircle yielding object, and anastigmatic image positions some distance outside of the region of strong field. The acceptance solid angle is $\Omega = 0.0061$ sterad and the momentum resolution with an 8-mm slit at the detector is R = 128. The ultimate resolution determined by spherical aberration and some residual astigmatism is about 1000. Applications to the study of the energy and yield of nuclear reaction products are discussed. 16 references. (auth)

195

THE MAGNETIC DEFLECTION OF FAST CHARGED PARTICLES IN THE PHOTOGRAPHIC EMULSION. C. C. Dilworth, S. J. Goldsack, Y. Goldschmidt-Clermont, and F. Levy. Phil. Mag. 41, 1032-57(1950) Oct.

Electron sensitive nuclear research emulsions have been exposed at sea level, and at the Pic du Midi (2800 m) in magnetic fields of the order of 34,000 gauss, in order to test the possibilities of curvature, within the emulsion itself, of the tracks of charged cosmic ray particles. The existence of measurable deflections of long tracks has been established by comparison of the results of measurements on field and no-field plates, and the method has been applied to determine the sign of particles in a group of cosmic ray phenomena in the exposures at high altitude. (auth)

196

MECHANISM OF THE FUNCTIONING OF A CERTAIN QUENCHING CIRCUIT FOR GEIGER-MÜLLER COUNTERS. L. Bell. Zhur. Eksptl. i Teoret. Fiz. 20, 480(1950) May. (Letter to editor; in Russian)

Neher and Pickering's quenching circuit has found new applications for several special forms of the G-M counter. Kozodaev has shown (Doklady Akad. Nauk S.S.S.R. 20, 25 (1938)) that its theory, given by Neher and Pickering (Phys. Rev. 53, 316(1938)) and still generally accepted, is erroneous, viz., that the circuit does not reduce the counter's dead time, and that, consequently, no essential difference exists between that system and the usual quenching by a resistance. The present author, while confirming Kozodaev's criticism, points to some advantages of the Neher-Pickering circuit over the usual one.

197

ON THE ATTENUATION OF THE TRACKS OF HEAVY NUCLEI IN PHOTOGRAPHIC EMULSIONS. Hoang Tchang-Fong and Daniel Morellet. Compt. rend. 231, 695-7(1950) Oct. 9. (In French)

On a series of five Ilford G5 plates exposed at a height of 30 km, about ten tracks of primary heavy particles terminating in the emulsion were observed. The charges Z of these nuclei were between 9 and 25. The correlation between Z and the attenuation (thin down) length L has been experimentally studied, and the equation $L = aZ^{\alpha}$ has been found to fit the data when α is approximately unity. This is in contrast to the theoretical equation $L \propto \frac{1}{2}Z^2$ developed by Frier, Lofgren, and Oppenheimer (Phys. Rev. 74, 1818 (1948)) from the Bohr hypothesis on the capture of peripheral electrons by the nuclei. In addition, the experimentally determined values of L are consistently higher than the theoretical predictions. The reasons for this disagreement are discussed.

198

ON THE FLUORESCENCE EXCITATION IN ORGANIC SUBSTANCES BY ALPHA PARTICLES AND GAMMA RAYS. Liselott Herforth. Ann. Physik 7, 312-20(1950) June 15. (In German)

In continuation of measurements of fluorescence in solid and liquid naphthalene, diphenyl, and phenanthrene (Broser et al., Z. Naturforsch. 3a, 6(1948); Herforth et al., Ann. Physik 4, 231(1949)), similar observations on transparency and yield under excitation with α and γ rays were made using a number of other organic substances. Furthermore, fluorescence spectra of those substances, when excited with α particles, were measured. (auth)

199

A PRECISION METHOD OF COUNTING RADIOACTIVE LIQUID SAMPLES. Arthur J. Freedman and David N. Hume. Science 112, 461-3(1950) Oct. 20.

Radioactive liquid samples offer inherently better possibilities for precision counting than do solid samples, since self-scattering errors caused by irregularities in sample shape are absent. A method of counting liquid samples, the surfaces of which are covered with thin lacquer films, with end-window Geiger tubes is described. The much greater precision that can be obtained by this method over solid counting has been demonstrated by tests with a series of isotopes having β energies ranging from 0.60 to 3.07 Mev. Isotopes with β energies of about 1 Mev or greater can be counted with an average precision of 0.5% or better. Lower β energies result in slightly poorer precision, because of the greater effects of sample and film thicknesses on the counting rate.

200

RADIATION DETECTORS FOR PROSPECTING. R. F. Errington. Can. Mining. Met. Bull. 43, 444-5(1950) Aug.

Remarks are confined principally to those instruments intended to detect gamma radiation in the field. These are of three types. G-M counters are by nature inefficient in that they count only a small percentage of the gamma rays which strike the tube. They are, however, very good indicators of activity. Ion counters or ionization chambers are at present very little used in the field. Scintillation counters are fundamentally more sensitive than G-M counters, principally because less incident radiation is wasted. Each ray produces some effect in the crystal and the effect of cosmic radiation can be minimized.

201

THE USE OF THE MASS SPECTROMETER TO MEASURE DEUTERIUM IN BODY FLUIDS. A. K. Solomon, I. S. Edelman, and Sidney Soloway. J. Clin. Invest. 29, 1311-19 (1950) Oct.

The use of D_2O for the measurement of total body water involves a very large dilution of the isotope, so that the precise accuracy with which the D_2O is measured becomes a key factor in obtaining quantitative estimates. The mass spectrometer has been used to measure deuterium concentration in body fluids in order to obtain a high order of accuracy. The procedure, calibration techniques, and accuracy obtained in such measurements are presented.

MESONS

202

MASSES AND LIFETIMES OF MESONS. Eugene Gardner, Walter H. Barkas, F. M. Smith, and Hugh Bradner. Umschau 50, 553-5(1950) Sept. 15. (In German)

A translation into German of portions of a paper by the above authors entitled "Mesons Produced by the Cyclotron" (Science 111, 191-7(1950); see NSA, abstract 4-2353) is presented.

203

THE MESON AS A COMPOSITE PARTICLE. H. M. Moseley and Nathan Rosen. Phys. Rev. 80, 177-81(1950) Oct. 15.

Calculations are carried out along the lines of the work of Fermi and Yang (Phys. Rev. 76, 1739(1949)) in which the π meson is considered as a composite particle formed from a proton and an anti-neutron. On the assumption of a vector interaction, it is found that the $^1S_0$ state must be excluded because its energy goes to zero as the interaction goes to zero, while the $^3P_0$ state appears to give an acceptable solution. On the assumption of a tensor interaction it is found that $^1S_0$ and $^3P_0$ solutions both exist, but for opposite signs of the interaction. The tensor interaction must therefore be excluded since it would lead to the formation of a composite particle by a proton and a neutron. Using the vector interaction one finds that the ground state is a $^3P_1$, but that there are other states with $j = 0$, 1 and 2 lying near it, the proximity depending on the interaction range assumed. (auth)

204

ON THE MAGNETIC MOMENT OF THE MESON. PART II. V. S. Vrkljan. Proc. Ind. Acad. Sci. 31, 325-9(1950) May. (In German)

In the first part of the work (Proc. Ind. Acad. Sci. 30, 205 (1949); see NSA, abstract 4-2364), by using Darvin's wave packets and Dirac's equations, the author has derived expressions for $\psi^*_{l,k}$ and $\psi_{l,m}$ necessary for the computation of the statistical charge density and the electric current of the meson. It is shown in the present paper how de Broglie's wave function $\psi_{l,m}$ can be directly derived from his equations of the meson (de Broglie, Particules à spin, Paris, 1943). (auth)

METEOROLOGY

205

THE DISPERSION OF HOT GASES IN THE ATMOSPHERE. O. G. Sutton. J. Meteorol., 7, 307-12(1950) Oct.

The problem of the dispersion of a stream of hot gas from a point is considered. It is shown that a plausible assumption concerning the mechanism of entrainment of air by the jet leads to simple expressions for the mean temperature and mean velocity of a jet of hot air rising in a calm atmosphere of uniform potential temperature. The theoretical expressions are shown to agree with laboratory measurements made elsewhere, and it is found that the coefficient of diffusion for these conditions is of the same order of magnitude as that which is derived from the large-scale spreading of cold smoke in the atmosphere. Finally, an approximate solution is given for the shape of the plume from a hot source in a horizontal wind, and it is demonstrated that the reduction of maximum concentration at ground level, caused by adding heat to the effluent from a stack, is directly proportional to the strength of the heat source and inversely proportional to the height of the chimney and the cube of the horizontal wind speed. (auth)

MICROWAVES

206

Columbia Radiation Laboratory
[FOURTH] QUARTERLY REPORT [FOR] 1949-1950. June 30, 1950. 38p. (NP-1738)

The status of work on the generation of high frequencies, on the design and construction of microwave equipment, and on microwave physics is reported. Absorption measurements in gases and determinations of the relative masses of stable Ge isotopes of even mass number have been made. The latter were calculated from the observed frequency differences in the absorption spectra and from the Bohr-Wheeler semiempirical values for Ge^{70} and Ge^{74} to be the following: Ge^{70}, 69.94952; Ge^{72}, 71.94818; Ge^{74}, 73.94862; and Ge^{76}, 75.95054.

MOLECULAR PHYSICS

207

MOLECULAR PHYSICS AND THE VIRIAL THEOREM. A. Michels. Physica 16, 183-4(1950) Feb. (Letter to the editor)

The text of the article is reproduced here in its entirety.

Some physical information on the character of molecular interaction can be obtained even with an equation as general as the virial theorem, which for stationary states reads: $2K = -R$, where K is the quantum mechanical average of the kinetic energy and R the virial (defined as the sum of the scalar products of forces and radius vectors $\sum_i (\underline{F}_i \cdot \underline{r}_i)$). We shall write the total energy E as $E = U + K$, where U is the potential energy, averaged quantum mechanically. Each interaction between two molecules can be described by a molecular field and understood as a total rearrangement of the constituent electrons and nuclei. This happens at every collision, but the time of intense interaction compared with the time between collisions is so small at ordinary gas densities that experimental evidence is difficult to obtain. At higher densities, however, the rearrangement becomes predominant. An exact calculation for the dense state is at present not possible. A rough approximation, which will at any rate show the character, can be obtained by considering a molecule to be enclosed by its neighbors, whose influence can be replaced by the wall of a small sphere with radius r_0. The virial is then $R = r_0 \partial E/\partial r_0 + U$, where the first term represents the virial of the forces necessary to keep the molecule in its box, and the second term is the well-known virial of the Coulomb forces between the electrons and the nuclei. From those equations we get $K = -r_0 \partial E/\partial r_0 - E$ for the kinetic energy of the electrons and the nuclei, and for the potential energy $U = r_0 \partial E/\partial r_0 + 2E$.

If we calculate the levels E of the molecules as functions of r_0, we can evaluate K and U as functions of this parameter. In principle this calculation is possible for any molecule; we give as a characteristic example the curves for the 1s, 2s, and 2p levels of atomic hydrogen, where $E(r_0)$ has been taken from a reference and $K(r_0)$ and $U(r_0)$ have been computed from formulas for K and U. (Increase of pressure P, corresponding with decrease of r_0, can be calculated with $P = -(\partial E/\partial r_0)/4\pi r_0^2$.)

NEUTRONS

208

DELAYED NEUTRON EMISSIONS. G. J. Nijgh. Nederl. Tijdschr. Natuurk. 15, 307-10(1949) Dec. (In Dutch)

In a short literature survey, the phenomenon of delayed neutron emissions is discussed. Such emissions are observed in the fission reaction of U (Hughes et al., Phys. Rev. 73, 111(1948); Hoffmann et al., Phys. Rev. 74, 1330(1948)), after the irradiation of Th^{232} or P^{231} with neutrons, and after the bombardment of F with 195-Mev deuterons (Alvarez, Phys. Rev. 75, 1127(1949)). In all cases the neutron emission follows the generation of a nucleus in an excited state. Sun (Phys. Rev. 76, 1266(1949)) sees in these phenomena an argument in favor of the existence of the antiproton.

209

DIFFRACTION OF NEUTRONS BY CRYSTALS. Hubert Curien. Rev. Sci. 87, 222-7(1949) Oct.-Dec. (In French)

The theory of diffusion and diffraction of neutrons in crystalline media, and methods of application of these phenomena in crystallography are outlined. In a final section, mention is made of the use of neutrons in a recent study of the arrangement of atoms in liquids (see also Chamberlain, Phys. Rev. 77, 305(1950)).

210

MODULATION OF THE NEUTRON FLUX IN A PILE REFLECTOR BY ABSORPTION AND DIFFUSION. Victor Raievski and Jacques Yvon. Compt. rend. 231, 343-5(1950) July 31. (In French)

Weinberg et al., (Phys. Rev. 74, 851(1948)) gave a theory of a pile oscillator, i.e., of an absorber moving back and forth in the field of thermal neutrons of a chain reactor. Hoover et al., (Phys. Rev. 74, 864(1948)), by applying this theory to the case in which the diffusion in the oscillating sample is negligible or is eliminated, gave a method for the determination of absorption cross sections of isotopes. In this paper, using the theory and experimental data obtained with the heavy-water pile at Châtillon, France, the reverse case is examined, viz., that of an oscillating block of a material, such as graphite, pure or containing traces of boron, in which diffusing processes predominate over the absorption. The method suggested gives the fundamental harmonic component of the perturbation. The phenomenon is a cumulation of a local perturbation, in phase, and a general modulation in which the phase lag is reduced through the influence of lagging neutrons and where absorption and diffusion act antagonistically. The period assumed is 28.5 sec.

NUCLEAR PROPERTIES

211

Argonne National Laboratory
THE $B^{10}(n,\alpha)$ REACTION AND THE LOW EXCITED STATE OF Li^7. D. R. Inglis. July 24, 1950. 17p. (ANL-4489)

Conflicting evidence concerning the nuclear spin I of the low excited state of Li^7 and Be^7 is discussed. The great preference of the thermal neutron reaction $B^{10}(n,\alpha)Li^7$ for the transition to the excited state has a natural explanation if $I = 3/2$, but if $I = 1/2$ a rather unlikely behavior of the incalculable matrix elements is required, and the alphas leading both to the ground and excited states must have rather high angular momentum, making the thermal resonance abnormally narrow and requiring that the resonance fall within an estimated 30 kev of zero neutron energy. This is compatible with observed deviations from the "1/v law." Such an interpretation with $I = 1/2$ is considered less unlikely than the combined circumstance that the observed approximate lack of alpha-gamma angular correlation in this reaction (which follows naturally with $I = 1/2$) should be the result of chance with $I = 3/2$, and that deductions from nuclear models favoring $I = 1/2$ should be in error. It is thus likely but not certain that $I = 1/2$. 17 references. (auth)

212

Wesleyan University
MASSES OF Si^{28}, Si^{29}, Mn^{55}, Fe^{56}, Ni^{58}, Pd^{110}, Cd^{110}, Cd^{112}, Cd^{116}, AND Sn^{118}. Henry E. Duckworth and Richard S. Preston. April 25, 1950. 3p. (NYO-677)

A similar article by the same author was published in Phys. Rev. 79, 402(1950) July 15 as a letter to the editor, and was abstracted in Nuclear Science Abstracts as NSA 4-5486.

213

THE CROSS SECTION FOR PHOTO-DISINTEGRATION OF THE DEUTERON AT LOW ENERGIES. G. R. Bishop, C. H. Collie, H. Halban, A. Hedgran, K. Siegbahn, S. du Toit, and R. Wilson. Phys. Rev. 80, 211-22 (1950) Oct. 15.

Precision measurements have been made of the photodisintegration of the deuteron with the γ rays of Ga^{72} and Na^{24}. Relative cross sections have been measured at quantum energies of 2.51, 2.62, and 2.76 Mev. Calibration of the sources gave absolute cross sections at 2.62 and 2.76 Mev. It was incidentally found that the 2.51 Mev γ line of Ga is double.

214

PILE NEUTRON ABSORPTION CROSS SECTIONS. S. P. Harris, C. O. Muehlhause, S. Rasmussen, H. P. Schroeder, and G. E. Thomas. Phys. Rev. 80, 342-4(1950) Nov. 1.

Neutron absorption cross sections for more than 50 elements have been measured in the neutron flux of the Argonne heavy water reactor. Measurements were made by observing the oscillating component of reactor power as a neutron absorber sample was oscillated in and out of the central flux of the pile. Calibration was effected with boron. (auth)

215

ON THE SPACE EXCHANGE MAGNETIC MOMENTS OF LIGHT NUCLEI. Larry Spruch. Phys. Rev. 80, 372-5 (1950) Nov. 1.

The calculations were based on Sachs' phenomenological theory and on the independent particle model. Spin exchange moments were not included. Uncertainties in the parameters required to characterize the shell dimensions and the neutron-proton interaction, which was assumed to be of an entirely exchange nature, cause the calculated values to be uncertain by a factor of about 3; they are probably too large. For L-S coupling, the values found in the 1p shell for ^2P states for Li^7, Be^9, B^{11}, C^{13}, and N^{15}, and in the 1d shell for ^2D states for Ne^{21}, Na^{23}, Cl^{37}, and K^{39} were -0.04, -0.01, 0.1, 0.05, 0.1, -0.4, -0.1, 0.4, and 0.4 nuclear Bohr magnetons, respectively. For j-j coupling, the values found for $B^{11}(p_{\frac{1}{2}})^{-1}$, $C^{13}(p_{\frac{1}{2}})$, and $N^{15}(p_{\frac{1}{2}})$ were 0.2, -0.09, and 0.1, respectively. The signs and ratios of these values are such as to lead to the conclusion that the simple models used here cannot be brought into agreement with the data by the addition of space exchange contributions alone. The magnitudes are nevertheless reasonably large in some cases, and indicate that they must be included in any consistent theory of nuclear magnetic moments. (auth)

216

SOME NUCLEAR LEVELS. M. F. Soonawala. Indian J. Phys. 24, 315-19(1950) July.

On the basis of a simple nuclear model in which the nucleus consists of rare-gas nuclei, protons, and neutrons, and from which the energy levels of a nucleus of two constituents may be calculated from the elementary Bohr's theory of quantized circular orbits and an assumption as to the inter-constituent potential, the energy levels of Mg^{24}, considered as consisting of two particles of masses 20 and 4, and Be^8, consisting of two α particles, are calculated. Some agreement with experimental data is shown.

NUCLEAR REACTORS

217

THE NEW REACTOR AT BROOKHAVEN. Bull. Atomic Sci. 6, 314(1950) Oct.

This country's newest chain reacting uranium pile began operating in August 1950 at the Brookhaven National Laboratory on Long Island. Ground was broken for the reactor in August 1947. The pile is air-cooled, graphite-moderated, and employs ordinary uranium metal (i.e., not enriched in the fissionable isotope U^{235}). Besides the reactor proper and its 80-ft-high house, the completed project will include large adjoining laboratory buildings, a "hot laboratory" for handling intensely radioactive materials, and a fan house and 320-ft concrete stack for voiding the slightly radioactive air used to cool the pile. The construction cost of the entire complex is about 25 million dollars. (auth)

NUCLEAR TRANSFORMATIONS

218

EMISSION OF HEAVY FRAGMENTS IN NUCLEAR EXPLOSIONS. D. H. Perkins. Proc. Roy Soc. (London) 203A, 399-417(1950) Oct. 10.

Observations have been made on the energetic nuclear fragments emitted in "giant" cosmic-ray stars. The disintegrations were produced in the heavy nuclei of Ilford C2 and G5 emulsions exposed at high altitude. Methods are described for the identification of the fragments, both stable and unstable, with charges between 3 and 10 units. It is found that fragment emission may be interpreted in terms of an asymmetric fission process, which is highly probable when the nuclear excitation energy becomes comparable with the binding energy. The average kinetic energies of the fragments are considerably greater than those to be expected from the Coulomb repulsion, a fact which may be explained in terms of specifically long-range nuclear forces. The fragments exhibit a peculiar tendency to be emitted in directions perpendicular to the incident star-producing particle. The mass of the emitted fragment does not depend appreciably on the size of star. At present there appears to be no comprehensive theoretical explanation of the precise mechanism of emission of such particles. (auth)

219

THE EMISSION OF LONG-RANGE CHARGED PARTICLES IN THE SLOW NEUTRON FISSION OF HEAVY NUCLEI. K. W. Allen and J. T. Dewan. Phys. Rev. 80, 181-8(1950) Oct. 15.

Light charged particles with ranges greater than 6 cm of air, produced in the slow neutron fission of U^{233}, U^{235}, and Pu^{239}, have been studied in detail by coincidence counting methods. In each case particles with a continuous range distribution extending to about 50 cm of air were observed, the distribution showing a broad maximum in the neighborhood of 20 cm. Direct measurement of the energies of the light particles from U^{235} showed a fairly symmetrical distribution about 15 Mev with a maximum energy of about 26 Mev. Comparison of the energy and range distributions shows that all the long-range particles are α particles.

The frequency of emission of these α particles was found to be 1 in 405 ± 30 fissions for U^{233}, 1 in 505 ± 50 for U^{235}, and 1 in 445 ± 35 for Pu^{239}. No protons were observed, although the apparatus would have detected any with ranges lying between 10 and 100 cm of air. The energy distribution of fission fragments coincident with long-range α particles was also measured. The usual two peaks were observed, indicating asymmetric division of mass, but each peak was shifted to a lower energy than is observed in binary fission. Quantitative comparison of the energies involved showed that, on the average, the total kinetic energy carried away in fission accompanied by α emission is about equal to that liberated in binary fission. Possible explanations for α emission in fission are discussed. (auth)

220

THE LONG-RANGE PROTONS FROM THE DISINTEGRATION OF CARBON BY DEUTERONS AND A STUDY OF THE COMPETING REACTIONS. G. C. Phillips. Phys. Rev. 80, 164-70(1950) Oct. 15.

The excitation curves for the reaction $C^{12}(d,p)C^{13}$ have been determined at the three laboratory angles of 0, 90, and 150 deg for the range of deuteron energies 0.78 to 1.55 Mev. Resonances were observed at 0.91, 1.16, 1.30, and 1.435 Mev, corresponding to resonances found previously for the competing $C^{12}(d,p)C^{13*}$ and $C^{12}(d,n)N^{13}$. In addition, a resonance was observed for the long-range proton group at 1.13 Mev. The angular distributions of the long-range proton group have been determined for eight energies of bombardment and have been converted to center of mass coordinates. These angular distributions have been analyzed in terms of the Legendre polynomials and show no terms higher than the fourth order to within the experimental error of about 3%. The intensities, positions, widths, and angular distributions of the resonances are discussed. The excitation curves show the effects of large amounts of interference between states. The 1.30-Mev resonance is exhibited at 0 deg as an " antiresonance," while the 1.435-Mev resonance shows a shift of maximum yield of about 10 kev for the excitation curves at 0 and 150 deg. (auth)

221

NUCLEAR POWER ENGINEERING. Part XII. Andrew W. Kramer. Atomics (Chicago) 6, No. 5, 19-25(1950) Sept.-Oct.

The material covers the following: energy relations in the fission process, conditions necessary for fission, the mechanism of induced fission, calculation of binding energy, distribution of fission products, energy balance for the fission process, and the emission of delayed neutrons and their significance in the design of nuclear reactors.

222

PHOTO-DISINTEGRATION OF THE DEUTERON. J. A. Phillips, J. S. Lawson, Jr., and P. Gerald Kruger. Phys. Rev. 80, 326-31 (1950) Nov. 1.

A study of the photodisintegration of the deuteron using a cloud chamber as a detector has been made for γ-ray energies of 6.14 and 7.00 Mev from the $F(p,\alpha)O^{16*}$ reaction. By observing the number of photodisintegration protons and the number of electron pairs formed in the gas (CD_4) of the cloud chamber, the ratio of the photodisintegration cross section to the pair cross section is obtained. If a calculated value for the pair cross section is assumed, these data yield $\sigma = 25.7 \times 10^{-26}$ cm^2 for the $D(\gamma,p)N$ reaction at an average γ-ray energy of 6.55 Mev. A plot of the angular distribution of the photodisintegration protons agrees, within statistical limits, with $\sin^2\theta$, though there may be a slight asymmetry in the forward direction. (auth)

223

PHOTO-DISINTEGRATION OF SILVER AND ALUMINUM. B. C. Diven and G. M. Almy. Phys. Rev. 80, 407-14(1950) Nov. 1.

The energy and angular distributions of protons emitted from Ag and Al nuclei when irradiated with the x rays from a 22-Mev betatron were determined with the use of photographic nuclear emulsions. A maximum x-ray energy of 20.8 Mev was used with Ag and energies of 20.8, 17.1, and 13.9 Mev with Al. With Ag the number of neutrons emitted in the same irradiation was determined from the (γ,n) induced activity. The ratio of number of protons in each Mev interval to the total number of neutrons is compared to the same ratio calculated on the basis of various assumptions as to level density and nuclear reaction cross sections. The comparison suggests that the observed proton spectrum consists of two overlapping components. One is a lower energy group in rough quantitative agreement with calculations. The second group is a high energy tail (10 to 14 Mev) with a preference for emission at 90 deg to the x-ray beam. The ratio of total numbers of protons to neutrons emitted by Ag under 20.8-Mev bremsstrahlung radiation is 0.023 ± 0.008. With Al, protons are emitted with spherical symmetry. From the maximum energy of emitted protons the proton threshold of Al was determined to be 8.6 ± 0.5 Mev. The (γ,n) cross section of Ag^{109} was found to have a maximum of 0.32×10^{-24} cm^2 at 16.5 Mev, and that of Cu^{63} a maximum of 0.10×10^{-24} cm^2 at 17.5 Mev. For Al^{27} the cross section is still rising at 22 Mev.

224

PRODUCTION OF FAST DEUTERONS BY COLLISIONS OF FAST NUCLEONS WITH NUCLEI. Jean Heidmann. Compt. rend. 231, 473-4(1950) Aug. 21. (In French)

Very energetic deuterons have been observed in cosmic-ray stars and among the products of bombardment of various targets by 90-Mev neutrons at Berkeley. The calculation of the corresponding cross section, as given by Chew and Goldberger (Phys. Rev. 77, 470(1950)) is semiempirical in that one of the essential elements, viz., the wave function of a nucleon in the bombarded nucleus, is derived from the angular distribution of the deuterons produced. An approach free from that empirical character has been made by the author (Phil. Mag. 41, 444(1950)) for the case of a light nucleus whose mass is a multiple of 4; the problem is reduced to that of a bombardment of He. In the present note the case of a heavy nucleus is treated, in the Born approximation, by using the statistical model. The total cross section for the production of deuterons by 90-Mev nucleons is found to be 1.9×10^{-28} cm^2/nucleon; its dependence on the energy of the impinging nucleon is given by $\sigma = 7.7 \times 10^{-25}$ $(100/E)^5$ cm^2/nucleon (E in Mev).

225

THE PRODUCTION OF HIGH ENERGY DEUTERONS BY ENERGETIC NUCLEONS BOMBARDING NUCLEI. J. Heidmann. Phys. Rev. 80, 171-6(1950) Oct. 15. (See also Phys. Rev. 77, 470(1950) or NSA 3-1725)

A calculation is given of the cross section for production of fast deuterons ($\gtrsim$50 Mev) by fast nucleons ($\gtrsim$100 Mev) bombarding heavy nuclei. A corrected Fermi model is used. The dependence on energy is given and also the momentum wave function of a nucleon in a heavy nucleus. (auth)

226

PROTONS AND DEUTERONS EJECTED FROM NUCLEI BY 90-MEV NEUTRONS. James Hadley and Herbert York. Phys. Rev. 80, 345-54(1950) Nov. 1.

The angular and energy distributions of the fast charged particles emerging from nuclei bombarded by 90-Mev neutrons have been investigated. The results indicate that the nature of the collision process is determined predominantly by interactions of the bombarding particle with single nucleons rather than with the struck nucleus as a whole: angular distributions are found to be peaked in the forward direction for all emergent particles, the degree of peaking increasing with energy. Deuterons are found to be more concentrated in the forward direction than are protons. In the case of carbon, particles traveling in the forward direction with energies greater than 20 Mev consist of 60% protons, 36% deuterons, and about 4% tritons. (auth)

PARTICLE ACCELERATORS

227

University of Illinois Physics Department
AN AUTOMATIC OPERATOR FOR CYCLOTRONS. A. L. Saunders. Technical Report No. 2, June 13, 1950. 34p. (NP-1714)

An automatic device which makes it possible to operate the cyclotron with a minimum of manual attendance has been developed. It is necessary to start the cyclotron, tune it initially, and to select certain limiting conditions manually. Once these are selected, the automatic operator will operate the cyclotron. The equipment is guided by three detection devices which are (1) a section that is sensitive to pressure within the cyclotron vacuum chamber, (2) a section which determines if the cyclotron power oscillator is oscillating and whether it is oscillating in the correct mode, and (3) a section to determine whether the beam current has fallen below some preselected level. The pressure sensitive section removes the plate voltage from the power oscillator if the pressure in the vacuum chamber rises above a preselected level. It also causes other circuits to try to start the power oscillator as soon as the pressure has been reduced below the critical pressure. The section that detects oscillation is necessary to enable the automatic equipment to remove plate voltage in case the power oscillator should drop out of oscillation. When the power oscillator is again oscillating, this section signals another part of the automatic equipment to advance the power steps to the operating level. The third section sounds an audio warning if the beam current becomes less than a preselected level.

228

ELECTRONICS AND THE ELECTROSTATIC GENERATOR. Burridge Jennings. Proc. I.R.E. 38, 1126-38(1950) Oct.

The design of the electrostatic generator, its advantages, limitations, and the auxiliary equipment necessary to make it a tool for nuclear research are discussed. Emphasis has been placed on the function of electronics in this field both in the control and measurement circuits, and in the general problem of the electrostatic generator.

229

HIGH-ENERGY PARTICLES AND MACHINES FOR THEIR ACCELERATION. D. W. Fry. Nature 166, 580-1(1950) Oct.

Papers for a session of a mathematics association are reviewed. The nature of the forces within the nucleus, recent progress with the traveling-wave linear accelerator, the University of Birmingham 1000-Mev proton synchrotron accelerator, the 25-Mev electron synchrotron at the Atomic Energy Research Establishment at Harwell, a frequency-modulated cyclotron at Harwell, and evidence from cloud chamber studies of cosmic ray showers for the existence of two new particles are discussed.

230

Stanford University Microwave Laboratory
LINEAR ELECTRON ACCELERATOR PROJECT; STATUS REPORT, SEPTEMBER 1 - NOVEMBER 30, 1949. [nd.] 9p. (ML-109)

A summary of the work on the operation of the prototype accelerator and on construction of accelerator parts and klystrons for a one million volt accelerator is presented. No constructional details are included.

231

SHIELDING PROPERTIES OF THE CONCRETE WALL OF THE M.I.T. CYCLOTRON. Victor Delano and Clark Goodman. J. Applied Phys. 21, 1040-7(1950) Oct.

The shielding properties of the 4-ft concrete wall of the M.I.T. cyclotron have been studied, using foils for neutrons and x-ray films for gammas. Fast neutrons were measured by counting the beta-active products of $Al^{27}(n,p)Mg^{27}$, $Fe^{56}(n,p)Mn^{56}$, and $Al^{27}(n,\alpha)Na^{24}$ reactions, thermal activation being eliminated by Cd holders. Resonance (1.44 ev) and thermal neutron distributions, measured by Cd-In-Cd and In, with suitable corrections, were reduced to absolute intensities by comparison with a known flux. Measurements were made with cylindrical concrete blocks fitted into a 4½ in. diameter hole which extended through the concrete wall. The results indicate an attenuation factor of 8.3 per foot for the fast neutron component and 10 per foot for thermal neutrons. An estimate of the fast neutron flux above 4.5 Mev showed a transmitted intensity slightly higher than the presently accepted tolerance value when bombarding Be. The absolute thermal neutron flux was below the tolerance level. The root-mean-square distance and the diffusion length for thermal and resonance neutrons in concrete were estimated by considering the distributed source to be equivalent to a point source at the inner face of the wall. The absolute thermal neutron flux was below the tolerance level. The root-mean-square distance and the diffusion

length for thermal and resonance neutrons in concrete were estimated by considering the distributed source to be equivalent to a point source at the inner face of the wall. The γ-ray measurements were not convertible to roentgens. A mean energy of 2.7 Mev was obtained for the γ radiation within the wall. The attenuation factor for total γ radiation in the wall at large distances from the inner face was 5.9 per foot. (auth)

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Associated Electrical Industries, Ltd.
A SURVEY OF PARTICLE ACCELERATORS IN THE UNITED KINGDOM. D. R. Chick and M. J. Pentz. December 1948. 18p. (A-24(AEI))

A survey is given of the activities of a large number of groups working on the field of particle acceleration within the United Kingdom. The choice of accelerators to fit the projected fields of research is briefly discussed. The general problem of a heavy particle accelerator capable of extending the stability and precision of the electrostatic machine into the region of 15 to 20 Mev is also considered. (auth)

RADIATION ABSORPTION AND SCATTERING

233

University of California Radiation Laboratory
ON THE NUCLEON-NUCLEON INTERACTION. Robert Jastrow. Aug. 1, 1950. 25p. (UCRL-819)

A charge-independent interaction between nucleons is assumed, which is characterized by a short-range repulsion interior to an attractive well. It is shown that it is then possible to account for the qualitative features of currently known n-p and p-p scattering data. Some of the implications for saturation are discussed. (auth)

234

A DIFFERENTIAL EQUATION FOR THE PHASE IN THE NEUTRON-PROTON SCATTERING. Otto Bergmann. Acta Phys. Aust. 4, 62-70(1950) July. (In German)

A first-order differential equation is derived for the phase in the scattering of neutrons by protons, by which the constants of the asymptotic wave function of the process can be calculated. The equation has an exact solution in the case of a potential well; a simple error estimate can be made for the case of other potential functions. (auth)

235

THE INELASTIC SCATTERING OF HIGH ENERGY NEUTRONS BY DEUTERONS ACCORDING TO THE IMPULSE APPROXIMATION. Geoffrey F. Chew. Phys. Rev. 80, 196-202(1950) Oct. 15. (See also NSA 4-3501)

The high energy n-d inelastic scattering problem is formulated in such a way that the amplitudes for n-n and n-p scattering at the same energy appear explicitly. The formulation depends on (1) the large radius of the deuteron compared with the range of nuclear forces and high energy scattering amplitudes, and (2) the high velocity of the incident neutron compared to the zero point motion of the deuteron. The method does not depend on the weakness of nuclear forces compared to the kinetic energy of the neutron and is therefore not equivalent to the Born approximation. (auth)

236

ON SPIN-ORBIT INTERACTIONS AND NUCLEON-NUCLEON SCATTERING. K. M. Case and A. Pais. Phys. Rev. 80, 203-11(1950) Oct. 15.

It is shown that one way of explaining the high energy p-p scattering data is by means of a spin-orbit coupling introduced into the nuclear interaction. The radial dependence of this coupling should be such that it has a strongly singular behavior at $r = 0$ and a small tail. It seems feasible to retain the charge independence of nuclear forces for all energies explored so far. A possible connection with M. Mayer's interpretation of the shell model of heavy nuclei is indicated. (auth)

237

THE PENETRATION AND DIFFUSION OF Co^{60} GAMMA-RAYS IN WATER USING SPHERICAL GEOMETRY. Gladys R. White. Phys. Rev. 80, 154-6(1950) Oct. 15.

Ionization and G-M counter measurements of Co^{60} γ rays were made in effectively spherical geometry up to a distance of 252.8 cm (16 mean free paths of the primary radiation) corresponding to an exponential attenuation of the primary radiation by a factor of 8.8×10^{6}. The "build-up factor" was observed to climb up to 33.8 and to approach closely the theoretically predicted trend of asymptotic variation $r^{1.4}$. Preliminary information on the spectral distribution of the radiation is included. (auth)

238

Atomic Energy Research Laboratory
THE SCATTERING OF NEUTRONS BY THE WALLS OF A LABORATORY. M. B. Biram and J. H. Tait. August 1950. 22p. (AERE-T/R-563)

The flux of neutrons scattered back to the source is calculated for the following cases: (1) a source placed over a semi-infinite noncapturing medium corresponding to earth's surface, (2) a source placed in the gap between two semi-infinite noncapturing media, and (3) a source placed in a spherical room, for the cases when the source is at the center or is slightly off center. (auth)

239

THE SCATTERING OF 100-MEV ELECTRONS FROM A HEAVY NUCLEUS. George Parzen. Phys. Rev. 80, 355-60(1950) Nov. 1.

The results of a calculation of the scattering of 100-Mev electrons from a heavy nucleus with atomic number $Z = 82.2$ are described. For 100-Mev electrons the reduced de Broglie wavelength is about one-fourth of the radius of a lead nucleus and appreciable deviations from pure Coulomb scattering are to be expected. Three different models of the nucleus are considered. In the primary case, the nucleus is assumed to have a uniform charge distribution within its radius. The scattering for this model is calculated by the exact phase-shift method. In the two other models the effects on the scattering of varying the radius and of nonuniform charge distributions are investigated. The last two calculations are carried out by perturbation on the first. (auth)

240

SMALL-ANGLE SCATTERING OF SINGLE FAST ELECTRONS. Gerhard Schulze-Pillot and Walther Bothe. Z. Naturforsch. 5a, 440-7(1950) Aug. (In German)

Using Geiger counters, absolute measurements were made of single-electron scatterings in the region of small angles (13 to 25 deg); the energy of the electrons was 1 to 2.5 Mev and the scatterers employed were polystyrol, Al, Ni, Ag, and Au. Homogeneous primary particles were obtained by passing electrons from a Rn preparation through a lens monochromator. The scattering device also had a cylindrical symmetry. The numerical results agree, within 10%, with the theory of Mott (Proc. Roy. Soc. (London), 124A, 425(1929); 135A, 429(1931)). The causes of disagreement with values previously obtained (Bothe et al., Z. Physik 115, 497(1940)) are explained. (auth)

RADIATION EFFECTS

241

FORMATION OF MICROSCOPIC CRYSTALS ON CRYSTAL SURFACES IRRADIATED BY Po α RAYS. Leopold Wieninger and Norbert Adler. Acta Phys. Aust. 4, 81-4 (1950) July. (In German)

A formation of microscopic (a few microns) crystals on crystal surfaces irradiated with α particles from a Po preparation was observed. The substances examined were NaCl, KCl, KBr, CaF_2, and $CaCO_3$, and the microcrystals, whenever an identification was possible, were found to be the corresponding nitrates ($NaNO_3$ etc.). Since, under the influence of α rays, N of the air is oxidized into NO_2, and KCl with NO_2 in the presence of H_2O is known to produce KNO_3, the formation of the crystals can be understood; the moisture film on the crystal surface furnishes the H_2O.

RADIOACTIVITY

242

THE DECAY SCHEME OF Cl^{39}. R. N. H. Haslam, L. Katz, H. J. Moody, and H. M. Skarsgard. Phys. Rev. 80, 318-20 (1950) Nov. 1.

Argon has been irradiated and Cl^{39} has been produced by the reaction $A^{40}(\gamma,p)Cl^{39}$. The threshold was found to be 14.2 Mev. The Cl^{39} activity was found to have two β particles of energies 2.96 and 1.65 Mev, and two γ rays of energies 1.31 and 0.35 Mev, the low energy γ ray having a conversion coefficient of 0.05. A decay scheme is proposed. Consideration of the results show that A^{39} must have a half-life greater than 5 yr or a decay energy of less than 0.4 Mev. (auth)

243

THE DISINTEGRATION OF Ti^{45}. M. Ter-Pogossian, C. S. Cook, F. T. Porter, K. H. Morganstern, and J. Hudis. Phys. Rev. 80, 360-5(1950) Nov. 1.

The positron and photoelectron [gamma ray] spectra of 3.05-hr Ti^{45} have been studied. At least 96% of the positron transitions are to the ground state of Sc^{45} with a maximum positron kinetic energy of 1.022 ± 0.01 Mev. Less than 4% of the positron transitions are to an excited level of Sc^{45} at 450 kev. In addition, certain longer-lived activities are found in the chemically separated titanium fraction produced by both deuteron and proton bombardment of scandium oxide. Two of the activities are shown to be P^{32} and Sc^{46} impurities. (auth)

244

INTERNAL CONVERSION OF GAMMA-RAYS FROM Co^{60}, Cs^{134}, Zn^{65}. M. A. Waggoner, M. L. Moon, and A. Roberts. Phys. Rev. 80, 420-8(1950) Nov. 1.

The internal conversion coefficients of the γ rays from Co^{60}, Cs^{134}, and Zn^{65} have been measured with a double-coil, thin-lens magnetic β-ray spectrometer. Sufficient precision has been attained in several cases to verify the theoretical values and to obtain unambiguous identification of the multipole character of the γ rays. Internal conversion coefficients as small as 10^{-5} can be measured with a precision of 5% or better. The results obtained indicate that both of the γ rays from Co^{60} are electric quadrupole (EQ), the 560-kev γ ray from Cs^{134} is either EQ or MD (magnetic dipole) or a mixture of these, the 602- and 799-kev γ rays from Cs^{134} are both EQ, the 1.114-Mev γ ray from Zn^{65} is either EQ or MD or a mixture of these and the 1.363-Mev γ ray from Cs^{134} may be EQ. Further data on the decay scheme of Cs^{134} are given. The results show that, in combination with angular correlation measurements, internal conversion data determine the angular momenta and parities of excited nuclear states. (auth)

245

University of Michigan
AN INVESTIGATION OF THE ALPHA-RAY SPECTRUM OF POLONIUM. John J. Wagner. 1949. 141p. (NP-1642)

This doctoral dissertation includes: a review of prior work on gamma and alpha spectra of Po and questions raised by noncorrelation of theory and data; discussion of (1) theory of alpha spectrometer and design and testing of one used, (2) detection of spectrum by photographic track method, counting errors and development of plates, (3) physical and chemical properties of Po, and (4) preparation of Po sources; and graphical presentation of data and discussion.

246

ON THE DECAY OF K^{40}. C. Festa and M. Santangelo. Ann. Geofisica 3, 95-101(1950) Jan. (In Italian)

The total disintegration constant λ of K^{40} (which is the sum $\lambda_\beta + \lambda_e$ of constants of decays that end, respectively, in Ca^{40} and A^{40}) was calculated by using (1) an average of several values of λ_β measured by various workers, (2) the ratio λ_β/λ as determined by Ahrens and Evans (Phys. Rev. 74, 279(1948)), and (3) the age of certain lepidolites as reported by the last named writers. The result is in satisfactory agreement with those reported in other sources.

247

ON THE FINE STRUCTURE OF γ LINES OF RaC'. G. D. Latyshev. Zhur. Eksptl. i Teoret. Fiz. 20, 192(1950) Feb. (Letter to editor; in Russian)

In a former work (Latyshev et al., Izvest. Akad. Nauk S.S.S.R., Ser. Fiz. 13. 340(1949); NSA abstract 4-4693), a fine struc-

ture (many indentations) was described in the conversion spectrum of RaC'. New experiments did not show any fine structure. The error in the previous work was due to unsuspected changes in the topography of the magnetic field, which caused the indentations of the curve.

248

RADIOACTIVE ISOTOPES OF Ag AND Cd. Jane R. Gum and M. L. Pool. Phys. Rev. 80, 315-17(1950) Nov. 1.

A 40-day K-capture activity in Ag was established at Ag^{106} as the only common product of a number of reactions. The half-life of A_{b}^{110} was redetermined as 270 ± 4 days and that of Cd^{109} as 470 ± 8 days, each on the basis of a 5-yr straight-line decay. A 57 ± 2-min K-capture and 1.5-Mev positron-emitting activity was established at Cd^{105}.

249

SHORT-LIVED ISOMERS OF Ta^{181}. W. C. Barber. Phys. Rev. 80, 332-7(1950) Nov. 1.

Excited states of Ta^{181} which result from the 46-day β decay of Hf^{181} were investigated by the method of delayed coincidences. Using trans-stilbene scintillation counters and a coincidence system of about 1.3×10^{-8}-sec resolving time, a state with a half life of $1.08 \pm 0.05 \times 10^{-8}$ sec was observed. Delayed coincidence absorption experiments indicated that the radiation following the delayed state arises chiefly from a transition of about 0.5-Mev energy. The radiations preceding and following the 2.2×10^{-9}-sec state were also investigated and, in agreement with other recent results, no γ rays were observed in the preceding radiation. Possible assignments of spin and parity to the excited states of the Ta^{181} nucleus are discussed. The scintillation counter system was also used to search for delayed coincidences in the radiations following the decay of other isotopes. Sources of 5.3-yr Co^{60}, 225-day Ag^{110}, 2.7-day Au^{198}, 2.6-hr Mn^{56}, and 34-hr Br^{82} gave negative results. The 8×10^{-9}-sec state of Cd^{111} was observed in the decay of 2.8-day In^{111}. (auth)

RARE EARTHS AND RARE-EARTH COMPOUNDS

250

COEFFICIENT OF MAGNETIZATION AND MAGNETO-OPTICAL ROTATORY POWER OF CERTAIN SOLUTIONS OF RARE EARTHS AS A FUNCTION OF THE TEMPERATURE. Ch. Fert. Ann. faculté sci. Toulouse 60, 1-90 (1946, publ. in 1949). (In French)

The temperature dependence of magnetic properties of matter and of the Faraday effect was studied using trivalent ions of rare earths of the Ce group, of Sm, and of Gd. It is concluded that in the Faraday effect two terms are superimposed; one is proportional to the coefficient of paramagnetic magnetization, and the other is independent of the temperature. The character of thermal variations of magnetic properties of Sm differs from that of the neighboring elements.

251

THE PRINCIPAL MAGNETIC SUSCEPTIBILITIES OF SINGLE CRYSTALS OF RARE EARTH SALTS AT LOW TEMPERATURES. PART III. NEODYMIUM SALTS. A. Mookherji. Indian J. Phys. 23, 410-20(1949) Sept.

The principal susceptibilities of neodymium salts have been measured from room temperature down to liquid-air temperature. The results are discussed in terms of crystalline field theory. It is found that (1) although the mean susceptibility can be explained satisfactorily on the basis of a single cubic field even of the fourth degree, the absolute magnitude of the fourth-order cubic field estimated in this manner from the magnetic data will not be correct, (2) the cubic part of the field in the various neodymium salts, estimated from magnetic data on the assumption that the cubic part of the field is wholly of the fourth degree, is found to vary markedly from crystal to crystal, (3) the influence of the fourth- and sixth-degree terms of the cubic field on the Stark splitting of the rare-earth ions and crystals, and their large magnetic anisotropy, indicate that the low-lying energy levels as observed in absorption spectra cannot be attributed to a cubic field alone, and (4) the χ_1 axis of neodymium sulfate rotates by about 7 deg in the range studied. (auth)

SHIELDING

252

RAND Corporation
PARTICLE HISTORIES FOR PLANE SLABS; RESEARCH MEMORANDUM. Herman Kahn. Dec. 24, 1948. 12p. (RM-248(RAND))

A preliminary account of work on the application of sampling techniques to the problem of determining the transmission of radiation through shields is presented. It is believed that an efficient compromise has been reached between the calculation of a large number of easily calculated life histories of a particle and the calculation of a smaller number of more complicated histories. A method (the exponential transformation) for eliminating many of the difficulties of working with high attenuation is given, with details of quota sampling, combination of random sampling with numerical integration, extension to complicated problems, and generalization of the geometry.

THEORETICAL PHYSICS

253

DISTRIBUTION OF RECOIL NUCLEUS IN PAIR PRODUCTION BY PHOTONS. R. Jost, J. M. Luttinger, and M. Slotnick. Phys. Rev. 80, 189-96(1950) Oct. 15.

The angular and momentum distribution of the recoil nucleus in pair production by a photon is calculated covariantly by a method which utilizes the unitarity of the S matrix. The results are in disagreement with a recent experiment (Modesitt and Koch, Phys. Rev. 77, 175(1950)), particularly for small angles and high momentum transfers. The exact total cross section for pair creation is derived. (auth)

254

THE IRREDUCIBLE VOLUME CHARACTER OF EVENTS. I. A THEORY OF THE ELEMENTARY PARTICLES AND

OF FUNDAMENTAL LENGTH. B. T. Darling. Phys. Rev. 80, 460-6(1950) Nov. 1.

A theory of elementary particles is presented based on the postulates that the elementary particles are a material process and that with every such process there is associated an inherent irreducible volume of space time. The equations of motion are obtained from the wave equations of Dirac, Maxwell, etc., through a two-step correspondence principle consisting of replacing these equations by self-adjoint partial difference equations and then integrating these over the group manifold of the closed real orthogonal group G in four-dimensional space. This introduces a new fundamental constant of the dimensions of a length, the difference step ω. The resulting equations are relativistically invariant integro-difference equations in a complex four-dimensional space. They give a quantized mass spectrum when ω is purely imaginary. The masses of the electron, proton, and μ meson are predicted.

255

MATHEMATICAL FORMULATION OF THE QUANTUM THEORY OF ELECTROMAGNETIC INTERACTION. R. P. Feynman. Phys. Rev. 80, 440-57(1950) Nov. 1.

The validity of the rules given in previous papers for the solution of problems in quantum electrodynamics is established. Starting with Fermi's formulation of the field as a set of harmonic oscillators, the effect of the oscillators is integrated out in the Lagrangian form of quantum mechanics. There results an expression for the effect of all virtual photons valid to all orders in $e^2/\hbar c$. It is shown that evaluation of this expression as a power series in $e^2/\hbar c$ gives just the terms expected by the aforementioned rules. In addition, a relation is established between the amplitude for a given process in an arbitrary unquantized potential and in a quantum electrodynamical field. This relation permits a simple general statement of the laws of quantum electrodynamics. (auth)

256

A QUANTUM-MECHANICAL INTERPRETATION OF KOHLRAUSCH'S "NATURAL SYSTEM OF SCREENING CONSTANTS AND EFFECTIVE QUANTUM NUMBERS." Otto Theimer. Acta Phys. Aust. 4, 1-08(1950) July. (In German)

The usual approximation methods of solution of the atom problem are reviewed, the Slater procedure (Phys. Rev. 36, 57(1930)) being examined in a more extensive way than has been generally done. It is shown that the system of Kohlrausch (Acta Phys. Aust. 3, 452(1950)) corresponds to a wave-mechanical approximation in which the atom's eigenfunction is a simple product of the electron eigenfunctions, the latter having the form of Slater's fundamental function. Some special consequences and the general significance of these relationships are discussed. (auth)

257

SYMMETRIC QUANTIZATION. Walter Thirring. Acta Phys. Aust. 4, 125-8(1950) July. (In German)

It is shown that a quantization formalism, symmetric in space and time, can be easily derived from invariance requirements alone, without any correspondence assumptions. (auth)

258

University of Pennsylvania

TABULATION OF A FUNCTION FOR CALCULATING THE ROTATIONAL ENERGY LEVELS OF A RIGID POLYATOMIC MOLECULE. Enos E. Witmer. May 1950. 396p. (NP-1631)

The problem of the asymmetric rotator is examined in the light of quantum mechanics and explicit solutions are obtained by two different methods. Tables are included for computation of energy levels of rotating asymmetric molecules, both according to the Bohr quantum theory and to quantum mechanics. The spectra may thereby be interpreted and moments of inertia obtained for such molecules.

PATENTS

CHEMISTRY

259

APPARATUS FOR HANDLING RADIOACTIVE SOLUTIONS. W. Q. Smith and G. W. Struthers (to U. S. Atomic Energy Commission). U. S. Patent No. 2,531,953, Nov. 28, 1950.

The apparatus described in this patent is useful for handling radioactive solutions and includes a pipet specially designed so that after the pipet has been filled there is a minimum of danger of spillage therefrom. Means are provided for filling and discharging the pipet under protected reduced pressure conditions.

260

CORROSION TESTING APPARATUS. I. Kirshenbaum and D. A. McCaulay (to U. S. Atomic Energy Commission). U. S. Patent No. 2,532,257, Nov. 28, 1950.

This patent describes an apparatus for simultaneously testing a material such as a metal sample with a corrosive fluid and its vapor in a manner such that the actual effect of a volatile corrosive liquid agent on the metal members of a distillation tower may be closely approximated.

261

METHODS OF PREPARATION OF NEPTUNIUM TRIFLUORIDE. Sherman Fried and Norman R. Davidson (to U. S. Atomic Energy Commission). U. S. Patent No. 2,532,707, Dec. 5, 1950.

Neptunium trifluoride is produced by contacting an oxygen-containing compound of neptunium with hydrogen fluoride, preferably in the presence of oxygen, to form neptunium tetrafluoride which is subsequently further contacted with hydrogen fluoride and hydrogen to yield the trifluoride of neptunium.

262

METHODS OF PURIFYING BERYLLIUM OXIDE. J. G. Malm and C. A. Hutchison, Jr. (to U. S. Atomic Energy Commission). U. S. Patent No. 2,531,143, Nov. 21, 1950.

Beryllium oxide is purified by heating it in contact with steam to a temperature from 1000°C to the melting point and then cooling the resultant oxide-containing vapor to yield a condensate of purified beryllium oxide.

263

PRECIPITATION PROCESSES AND APPARATUS THEREFOR. L. G. Stang, Jr. (to U. S. Atomic Energy Commission). U. S. Patent No. 2,533,149, Dec. 5, 1950.

This patent describes a precipitation process and apparatus wherein a liquid subsequently to be filtered is prevented from passing through a filter by air pressure applied beneath the filter, the removal of the pressure permitting filtration to take place.

264

PROCESSES FOR RECOVERY OF C^{14} ACTIVITIES. B. A. Fries (to U. S. Atomic Energy Commission). U. S. Patent No. 2,532,490, Dec. 5, 1950.

C^{14} activities are recovered from neutron-irradiated metal nitrides by reacting the irradiated nitrides with mineral acid and gaseously entraining the C^{14} activities released.

265

THE PURIFICATION OF HYDROGEN. A. S. Newton (to U. S. Atomic Energy Commission). U. S. Patent 2,533,138, Dec. 5, 1950.

This patent teaches that by passing hydrogen over a large surface of uranium metal at a temperature between about 700 to 800°C all ordinary impurities are completely removed from the hydrogen.

ENGINEERING

266

CONTAINERS FOR RADIOACTIVE SAMPLES. J. F. Gifford (to U. S. Atomic Energy Commission). U. S. Patent No. 2,533,102, Dec. 5, 1950.

A shielded carrier or transfer device is disclosed which has multiple chambers for radioactive specimens, and means for readily obtaining access to any individual chamber.

267

FILTER AND VALVE MECHANISM. R. Q. Boyer (to U. S. Atomic Energy Commission). U. S. Patent No. 2,531,802, Nov. 28, 1950.

A valve mechanism selectively opens to a single conduit any one of a plurality of liquid lines while positively preventing leakage to or from the other of such lines to avoid undesirable losses.

268

FLANGED JOINT SEALING GASKETS. W. W. Chupp (to U. S. Atomic Energy Commission). U. S. Patent No. 2,532,891, Dec. 5, 1950.

The gasket seal described in this patent comprises a pair of rings of compliant material arranged concentrically and in spaced relation to form an annular cavity. In association with the rings are one or more mechanical stops adapted to limit the deflection which the rings may undergo during compression and to induce proper alignment of the surfaces which contact the rings.

269

VALVE CONTROL MECHANISM. J. B. McMahon and T. A. Abbott (to U. S. Atomic Energy Commission). U. S. Patent No. 2,533,491, Dec. 12, 1950.

This invention relates to a novel magnetic actuating means for a sealed valve assembly. The pole pieces of the magnets consist of two groups of coaxially arranged teeth separated by a diaphragm, the two groups of pole pieces being arranged in both a concentric and a coplanar relationship whereby a uniform torque is produced.

PHYSICS

270

AIR PROPORTIONAL COUNTERS. J. A. Simpson, Jr. (to U. S. Atomic Energy Commission). U. S. Patent No. 2,532,956, Dec. 5, 1950.

An improved proportional counter for the measurement of α particles is described which utilizes air at atmospheric pressure as the ionization medium and which will detect and measure α-particle emission exterior to the counter.

271

APPARATUS FOR MEASURING LOCAL VARIATIONS IN FLUX DENSITY IN A MAGNETIC FIELD. W. M. Powell (to U. S. Atomic Energy Commission). U. S. Patent No. 2,530,176, Nov. 14, 1950.

This invention relates to an apparatus for measuring variations in flux density of fields of electromagnets wherein local and absolute variations in flux density are represented by a voltage generated in a moving coil. This voltage is opposed by a voltage generated in a stationary coil, thereby compensating for changes in absolute flux density.

272

COINCIDENCE PROPORTIONAL COUNTERS. J. H. Manley (to U. S. Atomic Energy Commission). U. S. Patent No. 2,531,144, Nov. 21, 1950.

This patent covers a coincidence proportional counter having a plurality of collecting electrodes so disposed as to measure the range or energy spectrum of an ionizing particle-emitting source such as an α source.

273

COULOMBMETERS. J. E. Hammel (to U. S. Atomic Energy Commission). U. S. Patent No. 2,531,811, Nov. 28, 1950.

A coulombmeter is described which indicates the time integral of a weak current or voltage signal. The conversion of the input direct current to a proportional alternating signal is accomplished by means of a vibrating type converter in conjunction with a step-up transformer.

274

DETECTION APPARATUS. H. L. Anderson (to U. S. Atomic Energy Commission). U. S. Patent No. 2,532,874, Dec. 5, 1950.

This patent describes a highly sensitive apparatus for the detection and numerical counting of neutrons, particularly neutrons liberated in an (α,n) reaction. The apparatus includes an improved ionization chamber structure together with an improved combination α-particle source and sample holder.

275

ELECTRONIC COUNTING CIRCUITS. J. W. Kennedy, W. R. Baker, and C. E. Wiegand (to U. S. Atomic Energy Commission). U. S. Patent No. 2,532,503, Dec. 5, 1950.

This invention is concerned with a portable electronic device for counting ionizing particles such as α or β particles, the device having incorporated therein an integrating arrangement, the accuracy of which is substantially independent of the time interval between the integrated pulses.

276

ELECTRONIC REGULATOR. E. O. Lawrence, F. H. Schmidt, and V. B. Waithman (to U. S. Atomic Energy Commission). U. S. Patent No. 2,530,169, Nov. 14, 1950.

The patent describes an electronic regulator and protector circuit for a device having a filamentary cathode and a bombardment-heated cathode to automatically extinguish an arc formed between the two cathodes and simultaneouly regulate the arc current between the bombardment-heated cathode and an arc block.

277

FLUXMETER. W. R. Rathkamp (to U. S. Atomic Energy Commission). U. S. Patent No. 2,530,178, Nov. 14, 1950.

The fluxmeter described in this patent utilizes an element which will vibrate when placed in a magnetic field with a predetermined amplitude proportional to the field strength; in combination with the vibrating element is a device to measure the amplitude of the vibration.

278

MAGNETIC MEASURING APPARATUS AND METHODS. John De Pangher (to U. S. Atomic Energy Commission). U. S. Patent No. 2,531,807, Nov. 28, 1950.

This patent discloses a method and apparatus for determining the effective area of a coil by connecting a standard coil and a coil of unknown effective area in bucking relationship, applying a charge-inducing force at known angles to the axes of the coils, varying the angle between the axes until equal charges are induced in each coil, and determining from the angle between the coils the effective area of the unknown coil.

279

POCKET RADIATION ALARMS. R. J. S. Brown and H. G. Weiss (to U. S. Atomic Energy Commission). U. S. Patent No. 2,531,106, Nov. 21, 1950.

This patent covers a compact, portable, light-weight radiation alarm apparatus which may be carried on the person and which will sound an audible alarm when exposed to a predetermined amount of radiation.

280

PULSE HEIGHT ANALYZER. M. L. Sands (to U. S. Atomic Energy Commission). U. S. Patent 2,529,666, Nov. 14, 1950.

This patent covers an improved plural-channel electronic analyzing system for recording pulses of predetermined character and of a frequency up to about 12,000 ppm.

281

TACHOMETERS. H. A. Straus (to U. S. Atomic Energy Commission). U. S. Patent No. 2,531,833, Nov. 28, 1950.

A tachometer is described which produces, with a minimum of noise voltage at its output, an electrical voltage proportional to the instantaneous speed of rotation of a shaft which is free to move only a limited number of revolutions in either direction.

282

VOLTAGE PULSE GENERATORS. A. R. Simpson (to U. S. Atomic Energy Commission). U. S. Patent No. 2,531,830, Nov. 28, 1950.

The described invention provides a means for supplying periodic short, sharp voltage pulses, the frequency and intensity of which may be varied over wide ranges and the polarity of which mat be selected.